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At Low Cost, Easily Accessible Telepresence Using Mobile Phone

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Abstract - The term telepresence was tossed by Marvin Minsky in an article in 1980, that focused on giving the remote participation a feeling of actually being present.

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AT LOW COST, EASILY ACCESSIBLE TELEPRESENCE USING MOBILE PHONE

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At Low Cost, Easily Accessible Telepresence Using Mobile Phone

Dr. Amritpal Singh Brar^α & Raman Makhaik^σ

I. INTRODUCTION

a) What is Telepresence

The term telepresence was tossed by Marvin Minsky in an article in 1980, that focused on giving the remote participation a feeling of actually being present.^[1]

This word brings a picture of video conferencing into our mind immediately, but it refers to the situation when a person is present at one place and it could communicate verbally and non verbally and could be able to stimulate his actions at other place too. We can well understand it by an example like:- a person is controlling a robot and that robot is driving a car. Or a doctor from a far away place is operating a patient, the technology of today demands more, so the researchers and developers of day today are trying to achieve each and every possibility of telepresence.^[2]

Till now telepresence has got remarkable progress, it uses a remote access to a device i.e a robot usually.

Main achievements are like the use of telepresence in surgery, it has got high precision but it is for specific purpose only and is very costly and bulky.

b) Remote control: access a device from a distance

A **remote control** is an electronics device, most commonly used in television sets, car locks, home appliances etc. The *remote control* is commonly called *remote*. Commonly, remote controls are Consumer IR devices used to issue commands from a distance to devices like tv, DVD players etc. Now a days remote controls don't just optimised to just few keys, the expectation of a user is huge, he wants to operate each and every thing from his position at rest and wants that the machinery should do all his work according to him via remote only. Most of the remotes communicate to their respective devices via infrared (IR) signals or via radio signals.

When we see around we can see a great change in our technology, in case of remote controls great changes are being there but the thing which makes the growth bounded is that it is "bounded", *yes talk about any of the remote control system it definitely have some boundations and limits but we propose a remote access which have greater coverage, one can*

access device from any corner of this world (having mobile network).

c) What is DTMF (dual tone multi frequency)

When we press any button on a telephone's keypad, a specific signal is being generate which is produced by two different signals i.e one high signal and one low signal. The produced signal is a new frequency that generates a new tone, the resultant of the tones selected by perssing a button from a row and column respectively. The resultant frequency signal is "*Dual Tone Multiple Frequency*". These tones are very specific and unique.^[3]

Hence A *DTMF* signal is the algebraic sum of two different audio frequencies, a low frequency and a high frequency selected according to the button pressed.

Each of the row i.e low frequency and the column i.e the high frequency groups comprise of four frequencies for the various keys present on the keypad. Two different frequencies, one from the high frequency group (column) and another from the low frequency groups (row) are used to produce a new discrete DTMF signal to represent the pressed key uniquely.

The amplitudes of the two sin waves should range in between:

$$(0.7 < (\text{Value of A/B}) < 0.9)V$$

The frequencies are chosen such that they are not harmonics of each other. The frequencies associated with various keys on the keypad are shown.

When we send DTMF signals to the telephone exchange through cables or wirelessly, the servers in the telephone exchange identifies those signals and makes the connection to the particular number that you are calling. The row and the column frequencies are:-^[3]

1	2	3	697 Hz
4	5	6	770 Hz
7	8	9	852 Hz
*	0	#	941 Hz
1209 Hz	1336 Hz	1477 Hz	

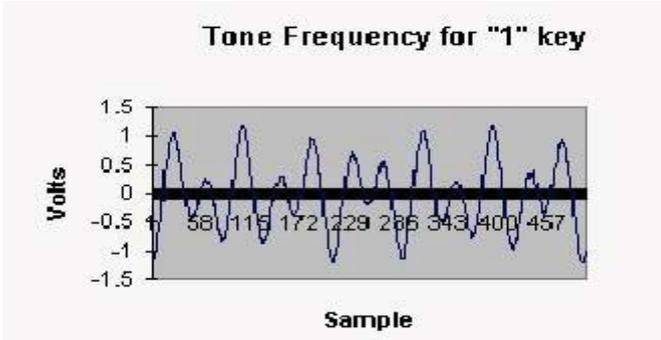
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For example:-

If we press the digit 2 in the keypad it generates a resultant tone signal which is made up of frequencies 697Hz and 1336Hz.

If we press digit 9 it will produce the tone taken from tones 941Hz and 1477Hz.



In simple phones the matrix of numbers on the key pad is 3*4 but actually it is of 4*4 so there are some special characters: A, B, C, D. these are being used for special purposes but rarely.

II. PRESENT WORK

a) Objectives

Main objectives are:-

- To transmit and receive the DTMF signals.
- To control the device using those DTMF signals.
- To assign particular action or motion to device for each DTMF signal.
- To use a 3G enabled phone and a camera on the device and communicate via it.
- To do different tasks using the system.

- To optimize the resources and increase performance.
- To complete the above tasks within time and less cost.
- Achieve telepresence.

Some other ideas that might be tried:-

- Try to send video signal over 2G network.
- Make the device that we are operating itself intelligent and interactive.
- Make a console in mobile to operate device.

b) Methodology

To implement our idea we need:

- Two cell phones and 3g enabled connections
- Two units of camera.
- Gear motors 100rpm.
 - Resistance R1 = 102 KΩ
 - R2 = 71.5 KΩ
 - R3 = 390 KΩ
- Capacitance
 - C1,C2 = 100 nF
- Crystal Oscillator
 - X1 = 3.579545 MHz
- Robo chassis
- Battery 12 v.
- Integrated Circuits-(like CM8870,L298)
- Connecting wire
- Breadboard Etc.

We would prepare the whole system setup which depends on software, electronics and mechanical aspects.

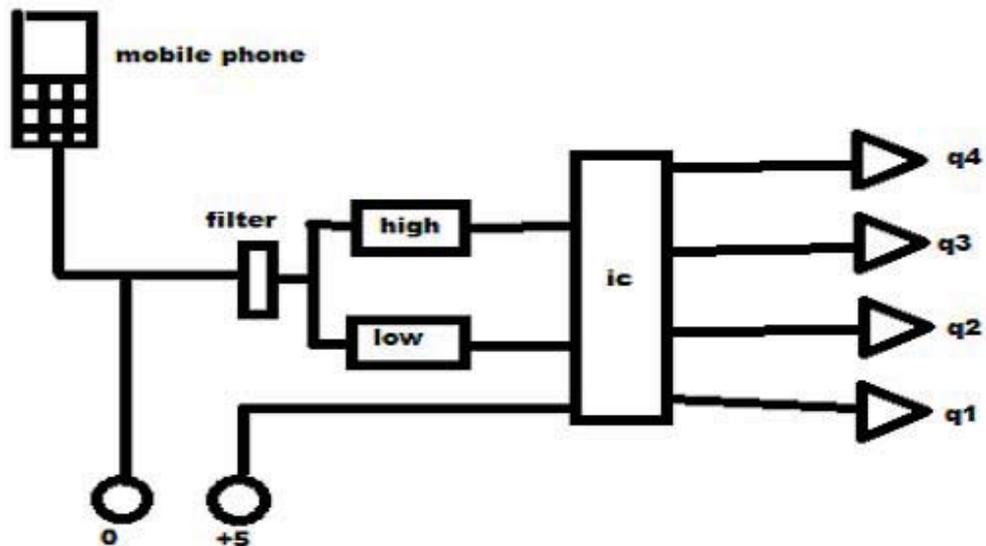
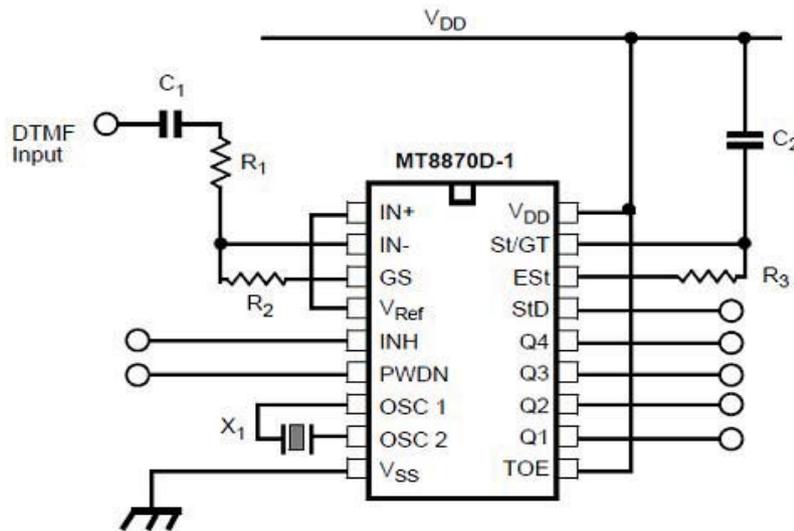


Diagram of DTMF receiver [3]

Let us assume that the signal is being transmitted from the mobile and now it reaches the cm8870;



CM8870

Pin #		Name	Description
18	20		
1	1	IN+	Non-Inverting Op-Amp (Input).
2	2	IN-	Inverting Op-Amp (Input).
3	3	GS	Gain Select. Gives access to output of front end differential amplifier for connection of feedback resistor.
4	4	V _{Ref}	Reference Voltage (Output). Nominally V _{DD} /2 is used to bias inputs at mid-rail
5	5	INH	Inhibit (Input). Logic high inhibits the detection of tones representing characters A, B, C and D. This pin input is internally pulled down.
6	6	PWDN	Power Down (Input). Active high. Powers down the device and inhibits the oscillator. This pin input is internally pulled down.
7	8	OSC1	Clock (Input).
8	9	OSC2	Clock (Output). A 3.579545 MHz crystal connected between pins OSC1 and OSC2 completes the internal oscillator circuit.
9	10	V _{SS}	Ground (Input). 0V typical.
10	11	TOE	Three State Output Enable (Input). Logic high enables the outputs Q1-Q4. This pin is pulled up internally.
11-14	12-15	Q1-Q4	Three State Data (Output). When enabled by TOE, provide the code corresponding to the last valid tone-pair received. When TOE is logic low, the data outputs are high impedance.
15	17	StD	Delayed Steering (Output). Presents a logic high when a received tone-pair has been registered and the output latch updated; returns to logic low when the voltage on St/GT falls below V _{TSt} .
16	18	Est	Early Steering (Output). Presents a logic high once the digital algorithm has detected a valid tone pair (signal condition). Any momentary loss of signal condition will cause Est to return to a logic low.
17	19	St/GT	Steering Input/Guard time (Output) Bidirectional. A voltage greater than V _{TSt} detected at St causes the device to register the detected tone pair and update the output latch. A voltage less than V _{TSt} frees the device to accept a new tone pair. The GT output acts to reset the external steering time-constant; its state is a function of Est and the voltage on St.
18	20	V _{DD}	Positive power supply (Input). +5V typical.
	7, 16	NC	No Connection.

c) *Significance*

This idea if implemented would be a great add on to the field of telepresence as till now telepresence is possible using high speed internet using computers or connected cables etc and the setup is costly. But in the proposed idea the telepresence would be possible with the most common gadget of today's life that is "a mobile phone" and using 3G we would be able to make telepresence a common phenomenon and people could do many tasks using it like:-

- Meeting people
- Driving a car(very enhanced)
- Defusing a bomb
- Look after your house from anywhere in this world.

The feature which makes it more significant is that it would have no limited area of access and you would be able to use it even from abroad, the condition is that your 3g mobile should work at that place from where you want to operate.

III. RESULT AND DISCUSSION

a) *Digital Output of Dtmf Receiver^[9]*

No	LowFreq	HighFreq	Q4	Q3	Q2	Q1
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

According to these outputs the motors are operated.

The person who is operating is also be able to see the other end and communicate at other end and

would be able to do some work also this is what is called telepresence.

It is ready to be used for:-

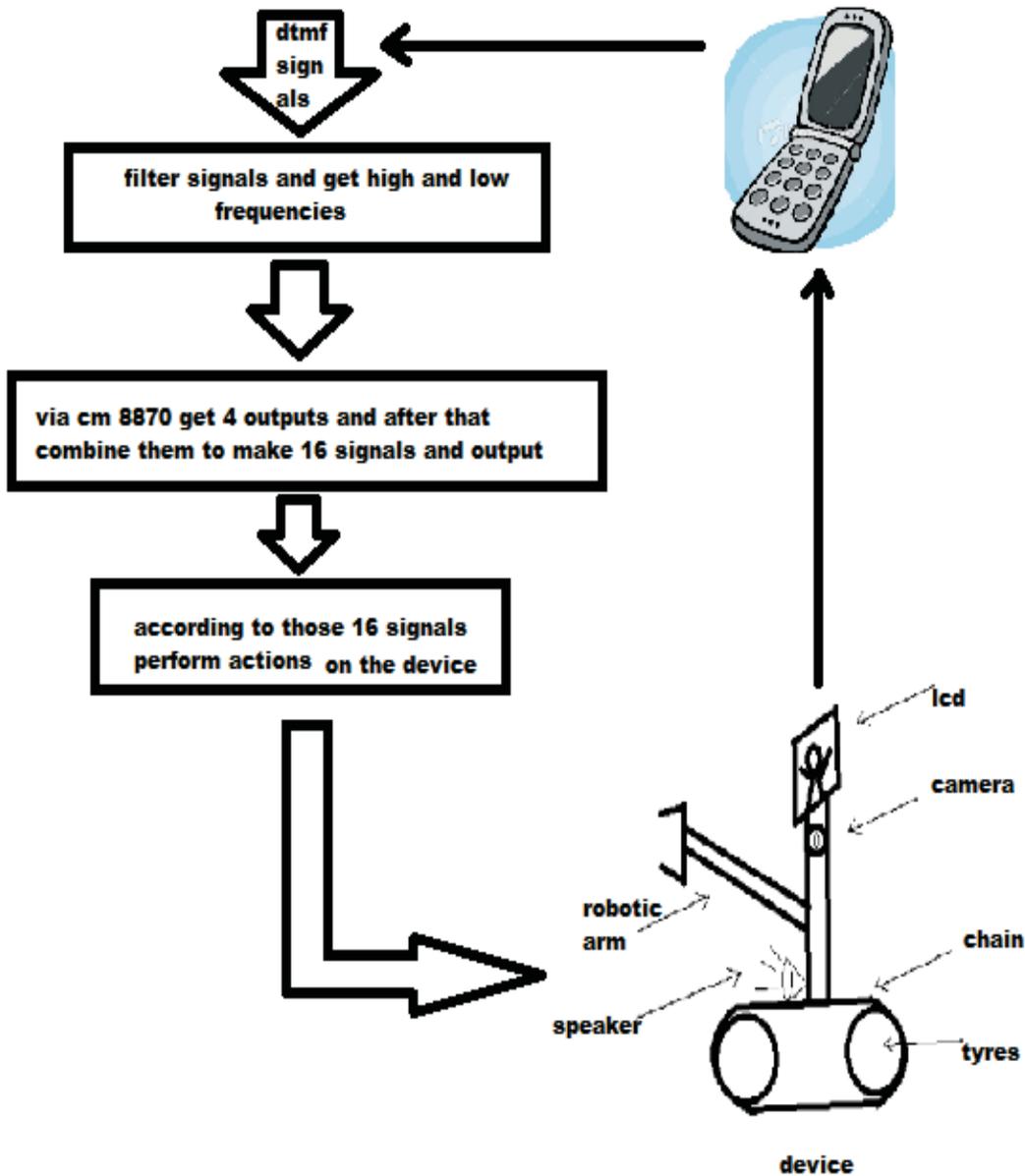
- Meeting people
- Move from one place to another
- Supervision
- Perform some action

b) *How it works*

In order to control the robot, you have to make a call to the cell phone attached to the robot from any

phone. Now the phone is picked by the phone on the robot through auto answer mode.
 When you press 2 the robot will move forward
 When you press 4 the robot will move left
 When you press 8 the robot will move backwards
 When you press 6 the robot will move right
 When you press 5 the robot will stop.

Diagram (How whole thing works)



IV. CONCLUSION AND FUTURE SCOPE

a) *Future Scope*

As the work done by us is only an initiation in this field so there is a big scope of work to be done in this field. As telepresence till now was not for common man and it was being achieved by bulky setups and

machinery. We are proposing a new way of achieving telepresence.

In future our robot if modified accordingly would be able to:-
 Functionality:-

- Drive car
- Operating machines in industry

- Bomb diffusing and many more.

Updation of technology:-

- Update device according to the mobile phone as 4g ,5g....
- Make it more effective and fast.
- Make a console in mobile to operate device.

b) *Conclusion*

We conclude that it can be said an initiation or a proposal of new way of telepresence by the use of which telepresence would become everybody's cup of tea. The cost is less and ease of access would make it more and more beneficial.

c) *Questionnaire*

Why only DTMF Signals?

- To make it easiest to access.
- To make it least costly.
- To have simplest setup for user.
- To make it such that everyone could use it.

Bottle necks?

- Hardware setup.
- Signal enhancement on receiver end.
- Cost effectiveness.
- Only 16 distinct signals.
- Time consuming concept.
- As the work is practical so difficult to make changes.