Detecting Alive Humans Using Embedded System

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Abstract— **Thousands of people killed as a cause of earthquake or landslides is a common news nowadays. There have been many such recent incidences. It was said if survivors has been found and rescue earlier the numbers of victims have been lower. The main question faced was how to enable rescue teams to enter the area, where many bodies are buried due to disasters. The worst effect was seen in the June 2013 when incessant rains that triggered landslides in Uttarakhand. The main problem faced by the rescue teams was how to enter the Kedarnath Valley. There is no end to the number of lives lost as the result of such disasters as landslides, collapsed tunnels and avalanches.**

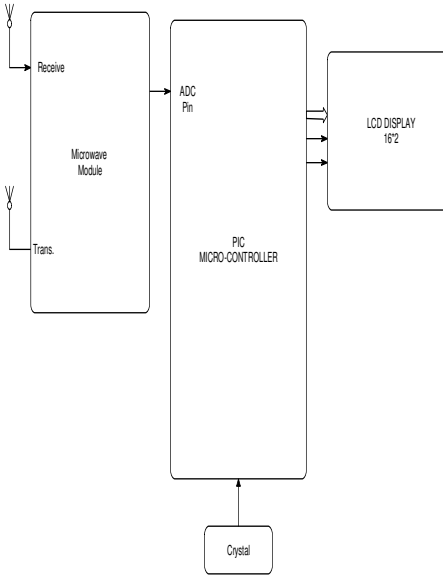
The microwave life detection system is developed for the search and rescue of victims trapped under the rubble of collapsed building during the earthquake or other disasters. The proposed system utilizes L-band frequency which is able to detect respiratory and heart fluctuations. The operation principle is based on Doppler frequency shift of the electromagnetic wave reflected from the buried victim[1]. By advent of this system the world death rate as a cause of an earthquake may decrease to greater extent.

Index Terms- Clutter signal, Doppler shift, dual antenna system, Life under rubble, modulation due to body Oscillations.

I. INTRODUCTION

Most of the victims of earthquake or other natural disasters in the various parts of the worlds are trapped under rubble of the collapsed buildings. A detection of the victims can save their life. As in the radar application, the phase of the incident wave can be changed due the body vibrations. Depending upon this fact "A System to Detect Human Being Buried under the Rubble"[2] used to trap the buried victims under earthquake rubble or collapsed buildings by the utilization of microwave radio frequency has been designed. Information about the location of buried person would be of great value for the rescue personnel, since it would help to reduce the time of operation and thus, help to save more lives.There is a need to construct a life detection system which can detect buried victims under earthquake or building debris most efficiently and as possible in short time. Such kinds of problems have been efficiently solved considering continuous wave or ultra wideband radars which offer good localization and spatial accuracy. In rescue mission and also in some surveillance operations there is not only the need of detect life signals but also the identification ofpeople in a given area, to facilitate rescue team operations in case of emergencies.

A new sensitive microwave life-detection system which can be used to locate human subjects buried under earthquake rubble or hidden behind various barriers has been constructed. This system operating at 1150 MHz or 450 MHz can detect the breathing and heartbeat signals of human subjects through an earthquake, rubble or a construction barrier of about 10-ft thickness.



Flow Chart For Antenna System

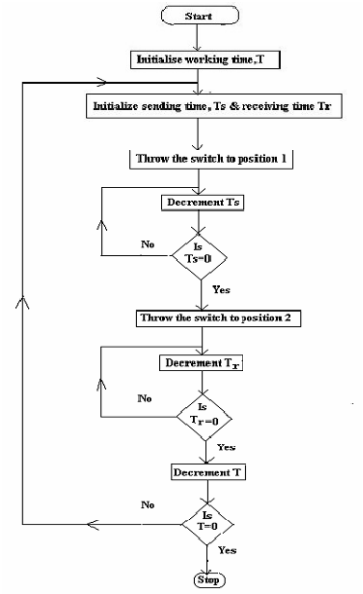


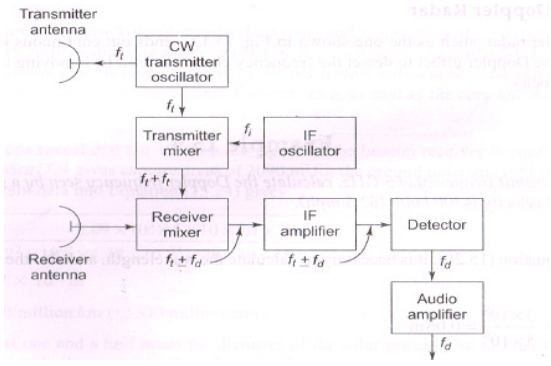
Fig: Flow chart for antenna system

Antenna:
The dual antenna system has two antennas, which are energized sequentially by an electronically controlled microwave single-pole double-throw (SPDT) switch. The switch turns on and off at a frequency of 100 Hz which is much higher than the frequency range of the breathing and heartbeat signals between 0.2 Hz and 3 Hz. Thus, we can consider that the two antennas essentially sample their respective objects at the same time. In this dual-antenna system, the two antenna channels are completely independent.
The algorithm and flowcharts for the antenna is as follows:
1. Initially the switch is kept in position 1 (signal is transmitted through the antenna 1)
2. Wait for some predetermined sending time, Ts
3. Then the switch is thrown to position 2 (signal is received through the antenna 2)
4. Wait for some predetermined receiving time, Tr
5. Go to step 1
6. Repeat the above procedure for some predetermined time, T.

Microwave Doppler Radar Sensor for Motion and Speed Sensing:

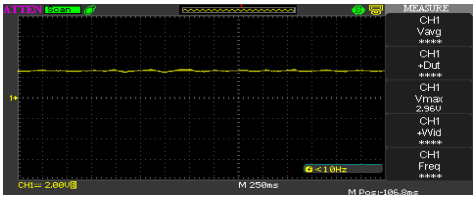
This sensor can detect motion or speed of moving objects through doppler principle. It transmits a 10 GHz microwave frequency electromagnetic signal and waits for the signal to receive back and monitors the shift in frequency signal. In general, the Doppler Effect is a shift in frequency perceived by a receiver from a signal source due to relative movement of the source and/or receiver. The most obvious way to see how this can affect electromagnetic waves is how astronomers use the color shift from light waves travelling from astral bodies to identify the speed these objects are moving away or toward the Earth.

BLOCK DIAGRAM OF DOPPLER RADAR

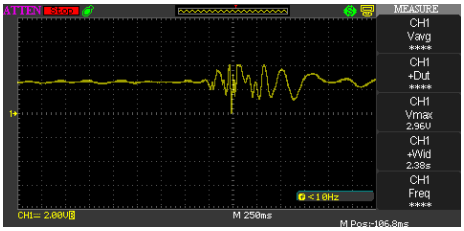


Interpreting output:

We connected the sensor output to Digital Oscilloscope and following are the readings No motion, sensor output is steady voltage at 2.9V.



We wave a hand in front once and we can see the output changing during that time. Note the fast changing wave at first and then getting steady as we stop waving hand in front .



II. WORKING PRINCIPLE OF SYSTEM

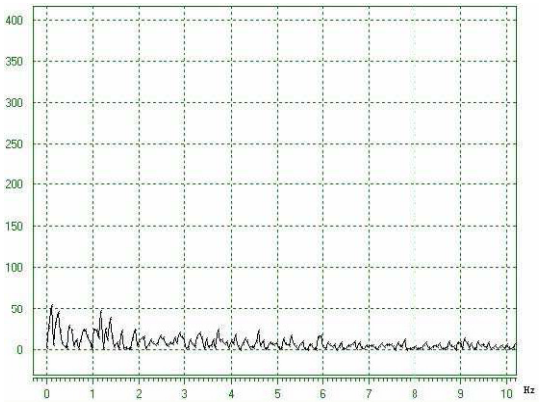
The principle of detection is firstly, microwave is sent through rubble to detect vital signs of life. Microwave is having the property to penetrate through barriers and would reflect back from some objects. These objects include humans. When the beam hits the body, the signal reflected with an additional modulation created by movement of heart and lungs. So, the reception of modulated signals shows the presence of alive human inside the rubble. With the modulated signal there are some signal (commonly known as clutter signal) which are reflected from the immobile object such as rubble or debris. Thus in order to maintain a high sensitivity for this application, the clutter wave reflected from the rubble or the surface of the ground has to be cancelled as thoroughly as possible. For this an automatic clutter cancellation system is used. A microwave life detection system operated on the radio frequency was proposed in the 1985[3]. This system detects the body oscillations occur due the breathing and heartbeat fluctuations. The system includes the additional subsystem to cancel the unwanted signals receive from the motionless objects such as rubble.

Frequency Bands**:**

The microwave life detection system can works on different range of frequencies from L-band (2GHz) to X- band (10GHz)[4].

DOPPLER EFFECT:

The Doppler Effect is a shift in frequency perceived by a receiver from a signal source due to relative movement of the source and/or receiver.Doppler radar system, a known frequency signal is transmitted from an antenna which is pointed at a reference object. A separate antenna is used to receive the signal that is reflected back from the reference to measure the Doppler shift of the signal.



Frequency spectrum of background noise

PIC16F877A DEVICE :

Here a microcontroller used is 'Peripheral Interface Controller'PIC16F874A/877A devices are available in 40-pin packages. It has 5 input output ports and 3 timers/counters. It has 15 interrupts and 8 A/D input channels. The Parallel Slave Port is implemented only on the 40 pin devices. Its operating speed is DC – 20 MHz clock input DC – 200 ns instruction cycle. It has 8K x 14 words of Flash Program Memory and 368 x 8 bytes of Data Memory (RAM).Its pin out compatible to other 28-pin or 40/44-pin.

It is advantageous since remote life sensing could be a powerful tool in applications where it is not desirable to disturb a subject's physiological and/or emotional state during detection or in other situations where access to the subject is limited. The frequency 2.45 GHz i.e. L-band frequency and this is free for use by commercial applications, so we expect a minimum interference with other devices during our tests. No need to use heart beat and the breathing sensor. Our interest in just to observe the minute movement of the victim.

INTRODUCTION TO SIMULINK:

Simulink is an environment for simulation and model-based design for dynamic and embedded systems. It provides an interactive graphical environment and a customizable set of block libraries that let you design, simulate, implement, and test a variety of time-varying systems, including communications, controls, signal processing, video processing, and image processing

It offers tight integration with the rest of the MATLAB environment and can either drive MATLAB

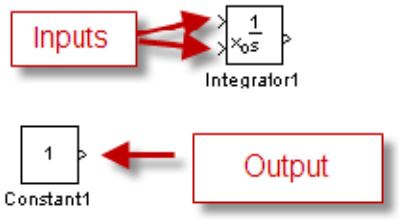
Library Browser:

The Simulink Library Browser is the library where you find all the blocks you may use in Simulink. Simulink software includes an extensive library of functions commonly used in modeling a system. These include:

1. Continuous and discrete dynamics blocks, such as Integration, Transfer functions, Transport Delay, etc.
2. Math blocks, such as Sum, Product, Add, etc
3. Sources, such as Ramp, Random Generator, Step, etc

Wiring Techniques :

Use the mouse to wire the inputs and outputs of the different blocks. Inputs are located on the left side of the blocks, while outputs are located on the right side of the blocks.



When holding the mouse over an input or an output the mouse changes to the following symbol.

Use the mouse, while holding the left button down, to drag wires from the input to the output.

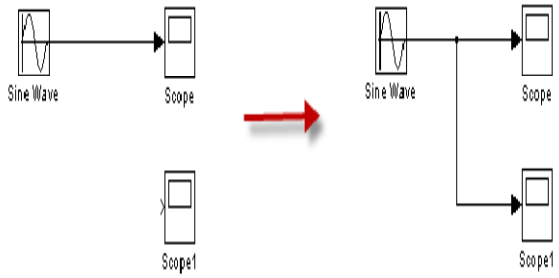
Automatic Block Connection:

Another wiring technique is to select the source block, then hold down the **Ctrl** key while left-clicking on the destination block.

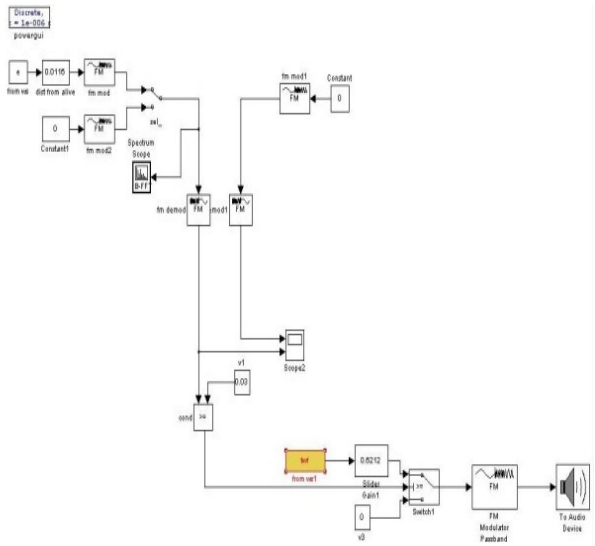
Try the different techniques on the example above.

Connection From A Wire To Another Block :

If wire a connection from a wire to another block, like the example below, you need to hold down the **Ctrl** key while left-clicking on the wire and then to the input of the desired block.



OUTPUT OF THE SYSTEM:



III. FUTURE SCOPE AND CONCLUSION

Alive human detection system can easily detect Buried victims under earthquake or building debris most efficiently and as possible in short time.

In rescue mission and also in some surveillance operations there is not only the need to detect life signals but also the identification of people in a given area, to facilitate rescue team operations in case of emergencies. This task can be complied with through the wall surveillance techniques. This system is applied for the search and rescue of victims trapped under the rubble of collapsed building during the earthquake or any other disaster .

From the format given above we conclude that by using microwave life detection system and matlab simulation system number of alive human beings under the earthquake rubble or behind barrier can be detected and rescued easily and successfully. And also by advent of this system the world death rate as a cause of an earthquake or any other disaster may decrease to greater extent.

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