

# Life Detection System Using L And S Band Microwave

Mitali Shewale<sup>1</sup>, Ankita Dahake<sup>2</sup>, Kranti Nikam<sup>3</sup>, Dr. M.H. Nerkar<sup>4</sup>

P.G. Students, Department of Electronics and Telecommunication Engineering, Government College of Engineering,  
Jalgaon, Maharashtra, India<sup>1,2,3</sup>

Professor, Dean (R&D) , Department of Electronics and Telecommunication Engineering, Government College of  
Engineering , Jalgaon, Maharashtra, India<sup>4</sup>

**ABSTRACT:**Thousands of people are killed during natural disaster which includes a cause of earthquake or a manmade disaster which can be the effect of building disaster, building collapse, an avalanche, collapsed tunnels or a landslides. There is no end to the number of lives lost due to the occurrence of such disasters. Existing systems to detect such victims affected by the calamity includes dogs, optical devices, acoustical life detector devices or robotic systems especially the rescue robots. This paper introduces the microwave life detection using L and S bands that is developed for the detection and rescue of victims trapped under the rubble of collapsed building during the earthquake or during the natural disasters or may be the victims hidden behind various barriers. This detection system based on Doppler frequency shift of an electromagnetic wave has an advanced microwave beam, the reflected wave from the victim will be modulated by their movements such as by breathing and heartbeats thus improving the efficiency and reducing the number of lives lost in the field during disaster along with the reduced time for rescue operation.

**KEYWORDS:** Rubble of building, Doppler frequency shift, Modulation of body movements

## I. INTRODUCTION

During this global criterion natural calamities are not accounted and are not an easily solvable crate. These unusual happenings cause loss of many human lives every year. Taking into account the results of human lives being left forever “A Revolutionary system to detect human being buried under the rubble” has been introduced and developed using the microwave system using L and S band to trap and detect the exact location of the buried victims during the calamities. By advent of this system the world death rate caused due to the unusual happenings such as a disaster may decrease to a greater extent. This rescue system operating at a particular band of frequency (L or S) band can detect the breathing and oscillations of heart beat signals buried under the rubble [4]. The reflected wave from the human subject will be modulated by their body movements. Information obtained about the location of the buried victim will help to rescue them and it would be of great importance which may reduce the time of operation required for the rescue operation thus saving more lives [2]. Due to the advent of this system, the problems have been efficiently solved considering continuous wave or ultra wideband radars which offer good localization and spatial accuracy [1]. Thus human victims buried under the earthquake rubble or debris during the calamity or behind the barrier can be detected easily.

## II. RELATED WORK

The manual method of rescuing the personnel from an unusual calamities is not efficient and effective as well as not appropriate and is also a time consuming task. There are several ways to prevent avalanches and lessen their power and destruction affecting humans. Nextly the use of sniffer dogs used for rescue of personnel to aid them in their rescue operation is also an ineffective method as it requires higher cost for the maintenance and training of the dogs and also is

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a time consuming and inaccurate stall. Another concept is the use of optical devices such as cameras used for identifying the survivors of victims but it needs to be lowered down into the rubble to look for the human lives affected during the calamity. This technique cannot be used for all location thus again an ineffective method since the penetration power is less [3]. The next concept is the use of acoustical detectors such as geophones that requires working environments which fails especially during monsoon and cloudy climates. Next technology is the use of motion sensor to detect the movements buried under the rubble and the breath sensor used to detect metabolites but there is a release of hazardous gas during the breathing and sweating process of humans and hence ineffective method.

### III. PROPOSED METHODOLOGY

Microwave signal is sent through the rubble or passed through debris to detect the presence of a life of victim buried under it. It then gets reflected back from human subjects or from some objects that may act as an obstacle. When the beam that is allowed to pass hits the body or the obstacle, the modulated signal is created by movement and the oscillation of heartbeat and breathing. If the clutter consisting of the reflected wave from stationary background and the reflected wave from human subjects body or from an obstacle is properly modulated, the signals of the subject can be exactly extracted and the exact location of the victim can be determined. Thus, a human subject buried under the rubble or under debris can be located and extracted thus saving their lives.

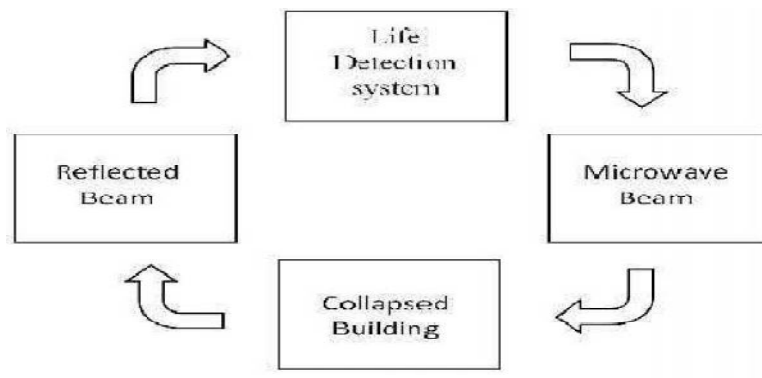


Fig.1 Principle of Microwave Life Detection System

### IV. EXPERIMENTAL RESULTS

Figure 2 shows the heartbeat signals measured by two-reflector antennas arranged symmetrically along with its time-domain and FFT representation. The cross-correlation result of the two sets of signals shows two different peaks representing the heartbeat frequency and its second harmonics respectively. This experimental results are obtained from the 1150 MHz life detection system. As shown in the figure the heartbeat signals are created by the artificial heart taken under consideration and is measured by reflector antenna A and reflector antenna B which are placed 7 ft directly above the target. The time-domain results of both A and B antennas shows the heartbeat signals and distortions contaminated by large noise. Their FFT results also shows the presence of a strong noise and the distortions with the spread in frequency. When we cross correlate these two sets of signals from antenna A and B, one distinctive peak of the heartbeat signal at 0.8 Hz appears and the second peak at 1.6 Hz as the second harmonic of the heartbeat signal appears. From the figure it is seen that the noise measured by both the antennas is considerably reduced to a larger extent and thus the heartbeat signal was clearly detected.

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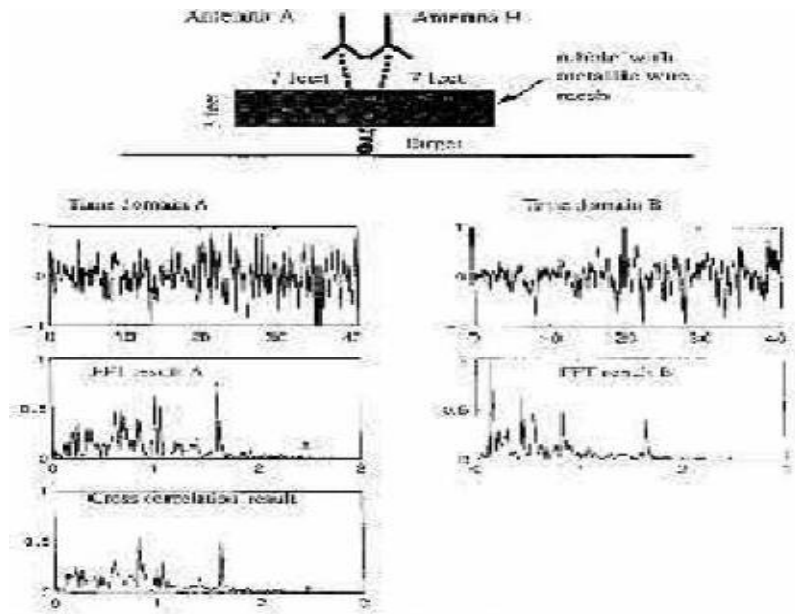


Fig.2 Heartbeat signals measured by Two-Reflector Antennas arranged symmetrically

Figure 3 shows the heartbeat signals measured by the reflector antenna and the probe antenna along with the time-domain and FFT representation. As shown the reflector antenna A was placed 21 ft above the target and the probe antenna B was inserted through the rubble in order to reach a point of 3.5 ft from the target. The FFT representation of the two antenna signals shows two sets of distinct peaks significantly the heartbeat signal and its harmonics. When cross-correlation of these two sets of signals is performed, a more distinctive heartbeat signal at 0.8 Hz and its respective second harmonic at 1.6 Hz are produced.

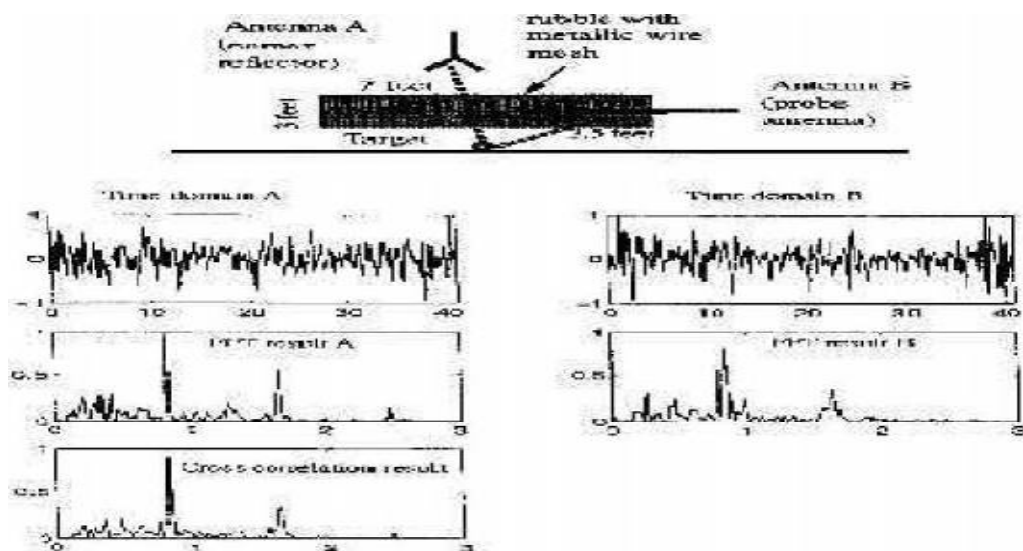


Fig. 3 Heartbeat signals measured by the Reflector and The Probe Antenna

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Figure 4 shows the heartbeat signals measured by the two reflector antennas along with the human operator interference walking near the rubble. The two reflector antennas A and B measures the heartbeat signals and are placed at a distance of 7 ft above the target when a human operator about 20 ft from the antenna was walking near the rubble. The interference signal as seen in the time-domain and the FFT representation are due to the human interference which produces a large distortion interfering signal at the outputs of antenna A and B. When the two signals from antenna A and B are cross-correlated, the heartbeat signal of 0.8 Hz and its second harmonic at 1.6 Hz appears whereas the interference signal nearly disappeared. From the above set of experimental results we can conclude that the dual antenna system of the 1150-MHz can be used to reduce the interference noise created by the antenna system and the human and system operators moving in the vicinity of the rubble as well as the background noise.

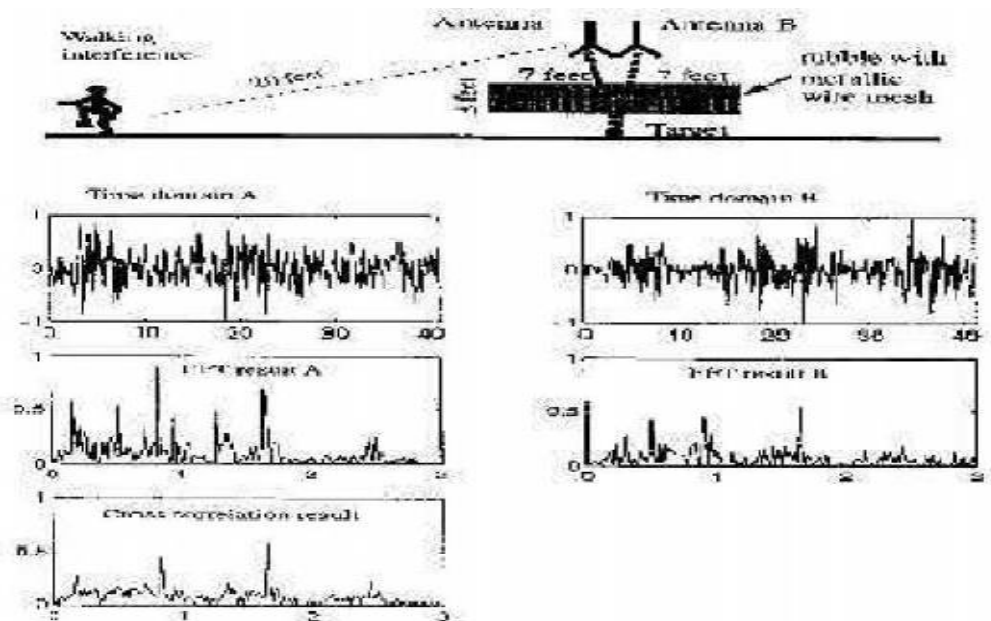


Fig. 4 Heartbeat signals measured by the Two Reflector Antennas  
along with the human Interference

### V. CONCLUSION

A new sensitive rescue life detection system using L and S band microwave for detection and location of human beings buried and hidden under the barriers has been designed, developed and implemented. This system operating at UHF band is capable to detect the breathing and heartbeat oscillation signals of human beings buried under the earthquake rubble or buried under the collapsed building or hidden behind the collapsed wall. This technique is easier to implement since the signals can be obtained easily rather than searching and going in depth to the core to obtain relevant information and diagnosing it. This analyzing method proves to be an efficient and accurate solution and can be implemented with an ease of build without requiring any skilled technician or a labour for its usage and for the system operation and maintenance. The idea of the microwave life detection system can be extended to develop further to extend the penetration range and power of the system than L band so that it can penetrate even from the metals to detect the victim buried under rubble. The range of operation can be enhanced to develop further so that it can cover more area thus detecting more number of victims and hence reducing the time required for the rescue operation eventually saving more lives. Through the development of similar and related techniques for life detection system using microwave it will be possible to overcome the current fundamental problems in detecting the rescuers. A more

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sophisticated and advanced embedded system and signal processing scheme may further improve the efficiency and system performance.

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