

Sonic Radar (SR)

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ABSTRACT

Radar has been essential part of world affairs from world war days to advance scientific and geological research. First developed for detection of unauthorised object in unauthorised premise has now evolved into large network of application. From the night warfare to oceanography from surveillance drones to underwater submarine all has been essential work net of radar. On recent years in war of Afghanistan and other battle fronts there was major issue of gun shots from unknown location during patrolling which resulted in non recoverable loss of fine soldiers. Sonic radar lets one to recognise the direction, distance of the sound agent such as gun shots within seconds which gives soldiers a better view of front then being confuse. This paper aims to do a brief research on sonic radar that is capable to map the sound producing agent and list the summary of results with the graphical test results. This paper demonstrates research on developed prototype.

1. INTRODUCTION

With changing global battle front and terrorism activity and operations to tackle them there has been a dire need of advance technologies that incapables the soldiers with more precise front map. No of global defence sector agencies have been working for producing equipments that allows a soldier to map their enemy position and also lets other researchers to map the subject of their interest. Sonic radar finds its place among those advance technologies which enhances the capability to find the sound producing agent from location far apart. It is either the enemy on shed or the animal in bush. In coming years with increasing global investment on defence and such other technologies Sonic radar is among their top priority enhancement.

1.1 Motivation

It is not doubtful that the coming global battle and military confrontments will be far different than those days gone by. Large military confronts are in doubt but the battle will be fought in places like rough terrains and cities of Afghanistan where its crucial to find the location of terrorist in crowd of people and vegetation. Also this radar finds its place among the biologists and animal surveyor in jungles or large places where the sound echoes after the initial sounding.

1.2 Structure

Sonic Radar is indigenious developments project which embeds various other open source software and media technologies to form one complete system for detection of object producing the sound. Today many type of visual detection techniques are developed by DARPA and other agencies but those are very costly systems and aren't open source which makes bulky for small world application in minor missions. Sonic Radar basically contains the array of microphones put together under one dome type structure. Each microphone represents the certain set of degrees. This dome type structure is connected to mobile sound analyser, detection and filtering unit via cable. Any sound triggers the microphone unit and it records the wave pattern. This system is mobile and works with battery power. Structure of radar unit is given in fig 2.1. This unit can be mounted in top of military patrolling vehicle or on any object according to the work purpose. Wave pattern is recorded in computer system via sound mixer and open source software Wavepad / Zone trigger is used for filtering the unnecessary sound and analysing the pattern. And then the result is displayed in VDU. Output is as shown in fig 2.2.

2. SONIC RADAR PROJECT

At the beginning of the project the main goal was a low-cost robust system which can capture the sound in its surrounding and demonstrate it via GUI reference about the location. This project was always projected for civil – military use whose inspiration began three months ago.

2.1 Sonic Radar

With rich experience of working with sound processing, editing and embedded system, this system was designed to be easy to use so it doesn't require advance learning and operating procedures to be followed. System is capable of operating on its own except a few lows need to rectified with further research on this

system. Although a few such system have been thought to be developed but are still out of production due to several inefficiencies.

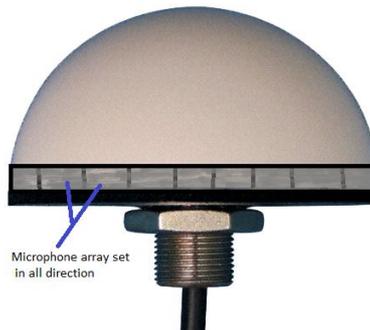


Fig 2.1 Sonic Radar Structure

2.2 Sound Detection

When any sound is detected by microphones, they process that sound signal to sound mixer then the individual sound pattern is matched against each other. The pattern with the largest amplitude is taken as the location of sound agent.

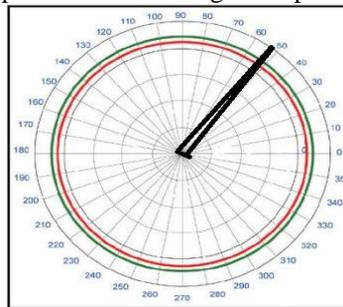


Fig 2.2 Graphical representation of sound source

2.3 Sound Processing

Microphone array is connected to the sound mixer via microphone in port. Sound Wavepad records the sound wave pattern then displays it graphically, whose data is used for recognising the sound agent by matching the wave pattern against one another.

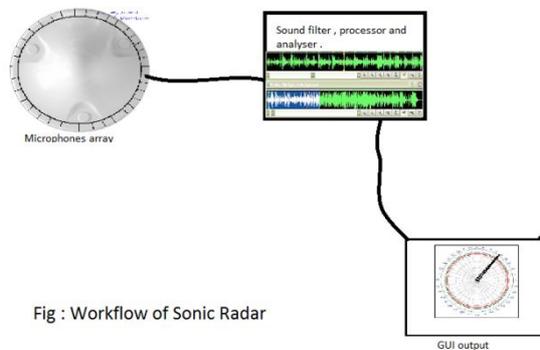


Fig : Workflow of Sonic Radar

Fig 2.3 Processing of Sound

2.4 Microphones

Sonic sound sensing unit contains the array of microphones put in all degree according to required resolution. Those array are connected to mixer by the analogue signal cord .Each microphones in array represents some certain degree. Whenever any sound is heard the microphone located the sounding agent records the loudest amplitude whereas other records the lower amplitude.

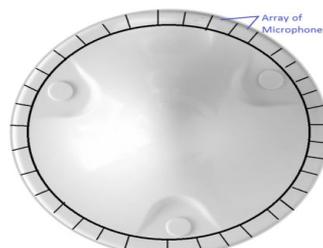
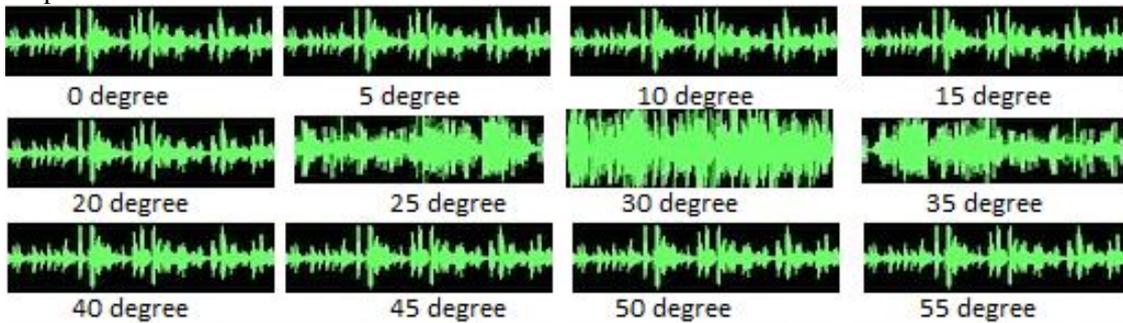


Fig 2.4 Top View of Sonic Radar unit

3. FIELD TEST

Field test was carried out in room with minimal sound interference. Array of microphone were put in different degree connected to mixer unit. A sound of 80 db was produced from the 30 degree with reference to the sound sensor unit. The wave pattern were recorded as shown below.



Wave pattern recorded by microphone in different degree

Fig 3.1 Wave pattern recorded by sonic radar from sound source located at 30 degree from the sonic radar.

Microphone located in 30 degree to the sound agent recorded the pattern with largest amplitude with the neighbouring microphones located at 25 and 35 degree recorded the second largest pattern as shown in in figure above. Thus the pattern data is interpreted to represent the sound agent location in graphical form as shown in figure 2.2.

4. CONCLUSION AND FUTURE WORKS

Sonic Radar comes handy in scenario where its crucial to find the sound source either it is in battle zone or in confusing areas / vegetation. Also comes in handy in surrounding producing echo. Sonic radar due to its rigid and simplicity is easy to implement and is cost effective advancement for foor soldiers and patrolling teams.

This system can be further enhanced to detect various other aspects of sound source like distance , sound source type and can also implemented for representing units in 3d scenario by matching the sound intensity and pre recorded pattern .

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