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Improved Version of Conventional Antennas for Wireless Communication

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ABSTRACT

We propose an improved version of conventional antennas. These intelligent antennas emit and absorb radio beams instead of the usual radio waves. These radio beams travel in specified directions and extend much farther than a signal of equivalent power that is broadcast in all directions. Instead of wastefully broadcasting personal communications in all directions, these innovative antennas track the position of receiver and deliver radio signals directly to the receiver. The signal power to be transmitted by the intelligent antenna is reduced drastically. These antenna systems maximize the reception of an individual receiver while minimizing the interference by others. In effect, the antennas create a virtual wire extending to each receiver. Thus making security a major feature of this intelligent antennas. Thus making it possible to prevent the losses of energy to a much greater extent and also in the same time creating a secure world ahead for transmission and security purposes.

Keywords:- Intelligent Antennas, patterning of radio waves, radio beam.

I. INTRODUCTION

The telecommunication industry has emerged to such an extent that the number of mobile phone users has evolved from a couple of thousands in the last decade to almost 10 million users in this decade. A radio antenna converts electric currents and voltages created by a transmitter into electromagnetic waves that radiate into space. The simplest and most common radio antennas, called dipoles, are merely rods of very specific lengths that radiate energy in all directions. Radio waves get weaker as they spread through space and are absorbed by obstacles such as air, trees, and buildings.

A person with suitable bandwidth radio will be able to interfere with another frequency by proper tuning. One solution to this problem lies in a new class of radio antennas that could dramatically reduce interference. Instead of wastefully broadcasting personal communications in all directions, these innovative antennas track the position of receiver and deliver radio signals directly to the receiver. These antenna systems maximize the reception of an individual receiver while minimizing the interference by others. In effect, the antennas create a *virtual wire* extending to each receiver.

II. THE COCKTAIL PARTY EFFECT

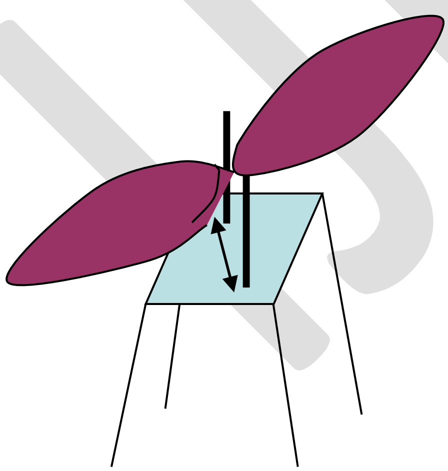
The key step is processing the information received by its antennas. A good analogy is the way the brain processes acoustic information from the ears. A person with normal hearing can usually locate the source of the sound even with his or her eyes closed. The convoluted folds of the outer ear produce differing resonances depending on the angle of the incoming sound. And unless the sound is coming from directly ahead or behind (or directly above or below), it reaches one ear before another, so there is a time lag between the two signals. The brain receives this information and rapidly computes the location of the source.

What is more, people with normal hearing can pick up relatively quiet sounds - say an interesting conversation, amid loud background noise. This phenomenon is known as cocktail party effect. Researchers have shown that the ability to focus on a specific sound partly depends on the ability to locate the sound's source. In an experiment that tested how well people can hear a signal while being blasted with background noise, subjects listening with both ears were able to detect much softer sounds than subjects listening with only one ear. Once the brain has determined the position of the acoustic source, it can focus on the sound and tune out unwanted noise coming from other directions.

Similarly, antennas can pinpoint the source of a radio signal and selectively amplify it while canceling out competing signals. The antennas brain is a digital processor that can manipulate the signals coming down the wires from the antennas.

III. ANTENNAS

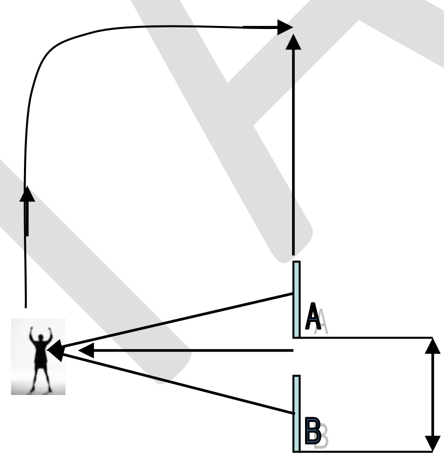
If we stand two antennas side by side, with the distance between them equal to one half the wavelength of the radio signal, the radiated energy from the simple antennas assume the pattern as shown in figure 1.The radio waves travel farthest in the two directions perpendicular to the antennas (that is, perpendicular to the line connecting the antennas), because in these directions the receiver would receive both antenna signals at the exact phase. When two identical signals are in phase, they combine to form a signal that is twice as strong as either one alone.



But in the directions parallel to the array, the receiver would receive the two antennas signals 180 degrees out of phase. The wave peaks from one antenna would arrive at the same time as the wave troughs from the other, so that the two signals would cancel each other out. This phenomenon creates a null, an area where the signal cannot be detected.
The beam generated by the two antenna array is a fairly broad one, and it extends in opposite directions. But the beam can be made narrower by increasing the number of antennas.

IV. WORKING OF THE ANTENNAS

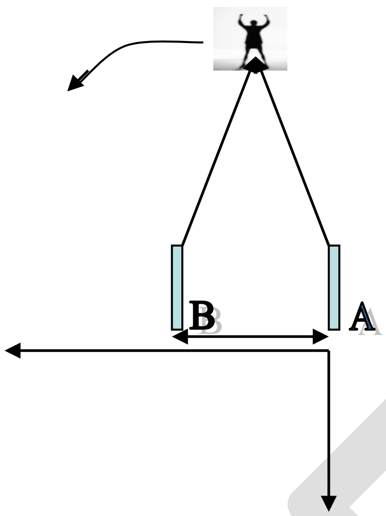
Let two antennas be named A and B. A and B are the fixed and Rota table antennas respectively. Consider the antennas to be in a position as shown in figure 2.



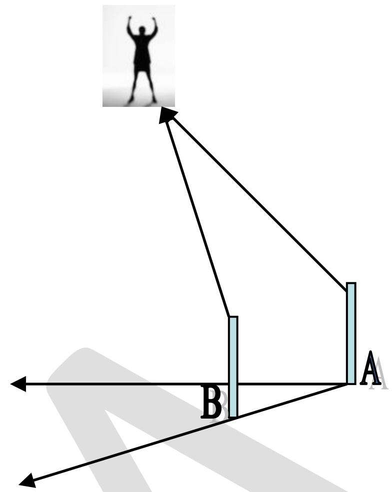
Considering A to be the centre of a semicircle and B to be rotating along the circumference of the semi circle whose radius is equal to half the wavelength of the signal emitted.
The receiver perpendicular to the axis of AB receives the signal with maximum intensity (i.e. sum of intensities of A and B) due to interference produced by the signals from the antennas A and B.
The receiver now moves in the clockwise direction and comes in line with both the antennas A and B. Now the signal received by B lags A by a phase angle $\lambda/2$. Considering a sine wave, the phase difference between A and B would be π. At this new position the signal received by the antennas will be minimum. To get the maximum intensity antenna B should be rotated 90 degrees in the

clockwise direction, i.e. half of the phase difference. So in general,

Angle to be rotated (desired angle) = $\frac{\text{phase difference between B and A}}{2}$



From the current position, if the receiver moves in the anti-clockwise direction, then B leads A. In such cases the microprocessor will be programmed to move the antenna B in the anti-clock wise direction. Let us consider that the receiver moves in the anti-clockwise direction and the phase difference attained by the antennas is π/3. So the desired angle is π/6. Since B leads A, the microprocessor moves the antenna B in the anti clockwise direction by an angle π/6.



V. SPECIAL CASES IN ROTATING THE ANTENNA

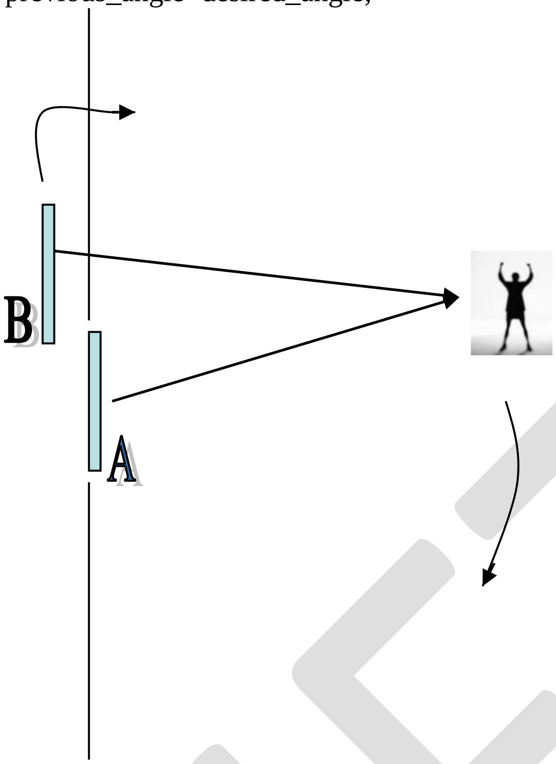
The antenna B is designed in such a way that it rotates around the antenna A unto a maximum of 180 degrees from the reference point Z. If the receiver moves to a location, such that the antenna has to move more than 180 degrees, then the following procedure will be activated.

ALGORITHM

```
Previous_angle=0;

Total_angle=0;
{
 desired_angle= phase difference between B and A
                          2
total_angle=desired_angle+perivous_angle;

if(total_angle>180)
{
 desired_angle= total_angle-180;
 total_angle=desired_angle;
 move the antenna B to 0 degree position;
}

if(total_angle<0)
{
 desired_angle=total_angle+180;
 total_angle=desired_angle;
```

move the antenna B to 180 degree position;
}

rotate the antenna B to the desired angle;
previous_angle=desired_angle;



Complexities

- For short distances, the co-ordination of the mechanical movement of the antenna with that of the receiver which may move faster might not be achieved accurately. This synchronization of movement can be better achieved with the help of more sophisticated stepper motors.

VI. CONCLUSION

As wireless carriers continue to pursue 4G networks, next generations of 5G network, LTE, cellular systems that transmit data in packets, intelligent antennas can be incorporated into many of these networks and also into the existing networks. This varied solution provides enhanced security features at a more economical rate. This technology can be extended to various other applications, many of which include controlling of robotic war tankers, intelligent corset. Thus the objective of the paper is attained and wireless communication is made quite secure.

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