ISBN: 978-93-90847-20-4

1. An Introduction to Smart Antenna for Wireless Power Transfer Technology & Cellular Phone Systems

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Abstract:

This chapter presents about the wireless structures which are simply an important part of modern-day society and are becoming extra as we flow towards the data society, call forget entry to greater information, more right away and in greater places. Concurrently, technological traits are making new applications viable, organizing up new markets, and promising huge monetary blessings. In all times, spectrum is an essential aid which notwithstanding the reality that reusable, can't be created to fulfill name for. It's miles therefore, increasingly crucial to enhance the performance with which use is fabricated from the spectrum. A novel method to recognize a smart antenna has been offered. The characteristics of smart antenna have additionally been defined. The performance of the simulated smart antenna has been studied. Smart antenna era provides range extension, expanded facts fee, higher network ability and better carrier exceptional.

Keywords: Smart antenna, cellular phone, Wireless power transfer & Spectrum.

1.1 Introduction:

In wireless power transfer, an idea at the start conceived by Nikola tesla in 1890s, energy is transmitted from a power source to a destination over the wireless medium. The usage of Wi-Fi energy switch can avoid the costly technique of planning and putting in energy cables in buildings and infrastructure. One of the challenges for imposing wireless power transfer is its low power transfer efficiency, as simplest a small fraction of the emitted energy can be harvested at the receiver due to intense course loss and the low efficiency of radio frequency (RF) - direct current (dc) conversion. Further, early digital gadgets, including first technology cell phones, had been cumbersome and suffered from excessive energy intake. [6]. The extensive kind of remote sensors utilized in its programs (loops, probe motors, radar, cameras, and so on.) is not as correct as a stationary analyzer transportation system [1]. Broadband wireless systems play an increasing number of crucial role in Intelligent Transportation Systems (ITS) by way of presenting high pace Wi-Fi hyperlinks between many its subsystems [2]. Smart antennas can extensively beautify the performance of wireless systems and satisfy the requirement of improving coverage variety, capacity, records charge and nice of company [3].

Obligation lies with the it's fashion designer to apprehend the running of a selected smart antenna in advance than it is used for the intended running surroundings. In the following sections we are able to speak types and running of clever antennas and the way they will be utilized in smart transportation structures and forte of the application of clever antenna technology, and in addition to cell communiqué systems.

1.2 Smart:

A smart antenna is a digital Wi-Fi communications antenna machine that takes benefit of range effect on the supply (transmitter), the vacation spot (receiver), or each. Range impact includes the transmission and/or reception of a couple of radio frequency (RF) waves to increase records pace and decrease the mistake price. The advent of effective low-price virtual sign processors (DSPS),trendy- reason processors (and ASICs), in addition to modern software program-based totally signal-processing techniques (algorithms)have made smart antennas sensible for mobile verbal exchange machine.[4] Today, when spectrally green solutions are more and more a business vital, those structures are presenting more insurance place for every mobile website online, better rejection of interference, and sizable capability improvements.

1.2.1 What are Smart Antennas?

Smart antennas (also referred to as adaptive array antennas, more than one antennas and, recently, MIMO) are antenna arrays with clever sign processing algorithms used to perceive spatial sign signature which includes directivity. The base stations are Omni- directional or sectored [5]. The power radiated in other directions could be experienced as interference with the aid of different users. The ideas of smart antenna is to use base station antenna patters that aren't fixed, but adapt to the perfect radio situations. This can visualized because the antenna directing a beam closer to the communication partner simplest.

1.2.2 Data Transmission in Smart Antenna:

A data transmission system using binary encoding transmits a sequence of binary digits, that is, l's and 0's. These digits may be represented in a number of ways. For example, a 1 may be represented by a voltage V held for a time T while a zero is represented by a voltage –V held for an equal time. In general the binary digits are encoded so that a 1 is represented by a signal sl (t) and a 0 by a signal s2 (t), where sl (t) and s2 (t) each have a duration T The resulting signal may be transmitted directly or, as is more usually the case, used to modulate a carrier. The received signal is corrupted by noise, and hence there is a finite probability that the receiver will make an error in determining, within each time interval, whether a 1 or a 0 was transmitted.

1.3 Baseband Signal Receiver:

Consider that a binary-encoded signal consists of a time sequence of voltage levels +V or –V If there is a guard interval between the bits, the signal forms a sequence of positive and negative pulses. [5-8] In either case there is no particular interest in preserving the waveform of the signal after reception.

We are interested only in knowing within each bit interval whether the transmitted voltage was +V or –V With noise present, the received signal and noise together will yield sample values generally different from ±V In this case, what deduction shall we make from the sample value concerning the transmitted bit? Suppose that the noise is Gaussian and therefore the noise voltage has a probability density which is entirely symmetrical with respect to zero volts. Then the probability that the noise has increased the sample value is the same as the probability that the noise has decreased the sample value. It then seems entirely reasonable that we can do no better than to assume that if the sample value is positive the transmitted level was + V, and if the sample value is negative the transmitted level was –V. It is, of course, possible that at the sampling time the noise voltage may be of magnitude larger than V and of a polarity opposite to the polarity assigned to the transmitted bit. In this case an error will be made as indicated in Figure 1.1. Here the transmitted bit is represented by the voltage +V which is sustained over an interval T from t1 to t2. Noise has been superimposed on the level +V so that the voltage v represents the received signal and noise. If now the sampling should happen to take place at a time t = t1 + Δt, an error will have been made.

We can reduce the probability of error by processing the received signal plus noise in such a manner that we are then able to find a sample time where the sample voltage due to the signal is emphasized relative to the sample voltage due to the noise. Such a processer (receiver) is shown in Figure 1.2. The signal input during a bit interval is indicated. As a matter of convenience we have set t = 0 at the beginning of the interval. The waveform of the signal s (t) before t = 0 and after t = T has not been indicated since, as will appear, the operation of the receiver during each bit interval is independent of the waveform during past and future bit intervals. The signal s(t) with added white Gaussian noise n(t) of power spectral density η/2 is presented to an integrator. At time t = 0 + we require that capacitor C be uncharged. Such a discharged condition may be ensured by a brief closing of switch SW1 at time t = 0– , thus relieving C of any charge it may have acquired during the previous interval. The sample is taken at the output of the integrator by closing this sampling switch SW2. This sample is taken at the end of the bit interval, at t = T The signal processing indicated in Figure 1.2 is described by the phrase integrate and dump, the term dump referring to the abrupt discharge of the capacitor after each sampling.

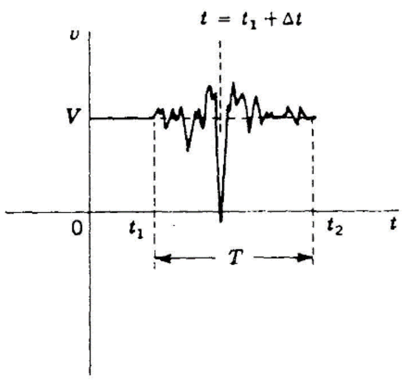

Figure 1.1: Illustration that noise may cause an error in the determination of a transmitted voltage level.

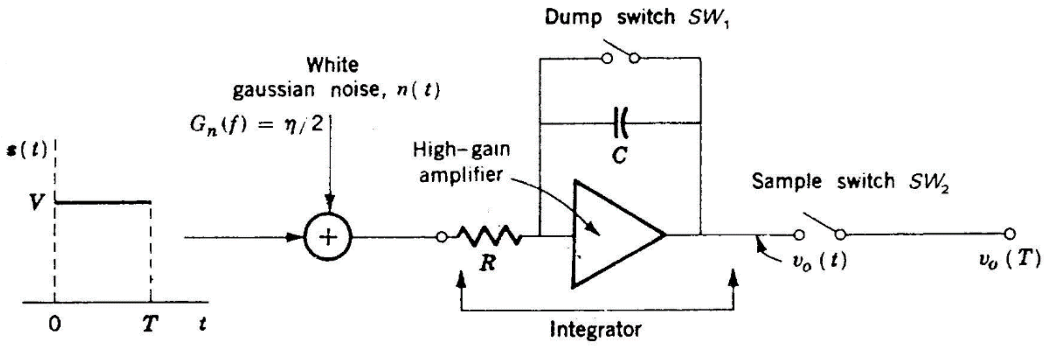

Figure 1.2: A Receivers for a Binary Coded Signal.

1.4 Pack Signal of Rms Noise Output Voltage Ratio:

The integrator yields an output which is the integral of its input multiplied by

$$\upsilon_0(T) = \frac{1}{\tau}\int_0^T [s(t)+n(t)]\,dt = \frac{1}{\tau}\int_0^T s(t)\,dt + \frac{1}{\tau}\int_0^T n(t)\,dt \qquad (1)$$

The sample voltage due to the signal is

$$s_0(T) = \frac{1}{\tau}\int_0^T V\,dt = \frac{VT}{\tau} \qquad (2)$$

The sample voltage due to the noise is

$$n_0(T) = \frac{1}{\tau}\int_0^T n(t)\,dt \qquad (3)$$

This noise-sampling voltage $n_0(T)$ is a Gaussian random variable in contrast with n(t), which is a Gaussian random process.

The variance of $n_0(T)$ was

$$\sigma_0^2 = \overline{n_0^2(t)} = \frac{\eta T}{2\tau^2} \qquad (4)$$

$n_0(T)$ has a Gaussian probability density.

The output of the integrator, before the sampling switch, is $\upsilon_0(t) = s_0(t) + n_0(t)$. As shown in Figure 1.3a, the signal output $s_0(t)$ is a ramp, in each bit interval, of duration T. At the end of the interval the ramp attains the voltage $s_0(T)$ which is $+VT/\tau$ or $-V\,T/\tau$, depending on whether the bit is a 1 or a 0. At the end of each interval the switch SW_1 in Figure 1.2 closes momentarily to discharge the capacitor so that $s_0(t)$ drops to zero. The noise $n_0(t)$, shown in Fig. 3b, also starts each interval with $n_0(0) = 0$ and has the random value $n_0(T)$ at the end of each interval. The sampling switch SW_2 closes briefly just before the closing of SW_1 and hence reads the voltage.

$$\upsilon_0(T) = s_0(t) + n_0(t) \qquad (5)$$

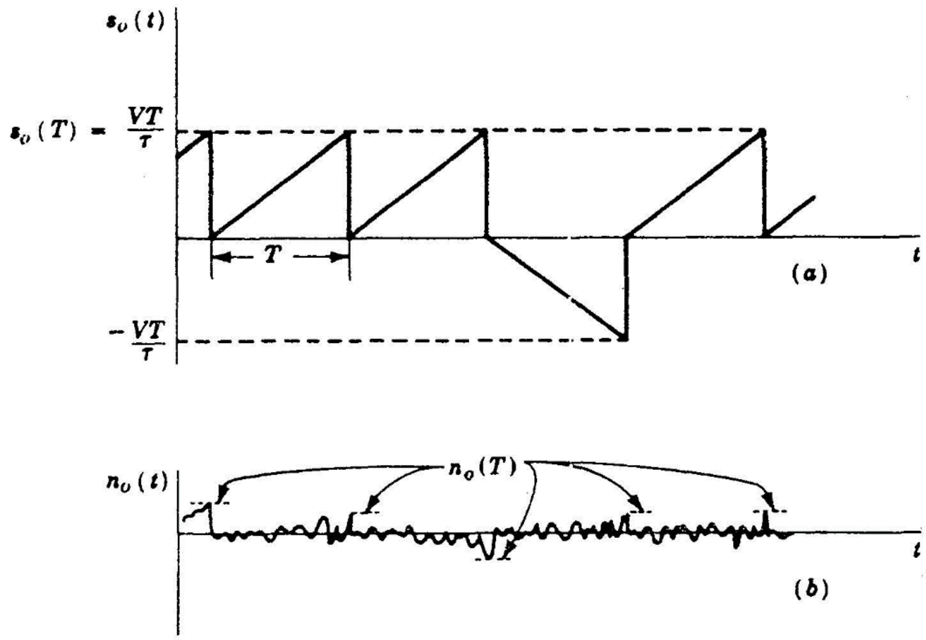

Figure 1.3: (a) The signal output and (b) the noise output of the integrator of Figure1.2

We would naturally like the output signal voltage to be as large as possible in comparison with the noise voltage. Hence a figure of merit of interest is the signal-to-noise ratio.

$$\frac{[s_0(T)]^2}{[n_0(T)]^2} = \frac{2}{\eta} V^2 T \qquad (6)$$

This result is calculated from Eqs. (2) and (4). Note that the signal-to-noise ratio increases with increasing bit duration T and that it depends on V^2T which is the normalized energy of the bit signal. Therefore, a bit represented by a narrow, high amplitude signal and one by a wide, low amplitude signal are equally effective, provided V^2T is kept constant. It is instructive to note that the integrator filters the signal and the noise such that the signal voltage increases linearly with time, while the standard deviation (rms value) of the noise increases more slowly, as $\sqrt{T}$.

Thus, the integrator enhances the signal relative to the noise, and this enhancement increases with time as shown in Eq. (6) and table 1.1 shows the parameters for model communication system.

Table 1.1: Parameters for Model Communication System

Item	Values
Frequency Band	5.8 Ghz Band
Maximum Zone Length	100m
Maximum Zone Division	4
Maximum Zone Length	25m
I/O Port Number	2
Antenna Height	8m (Roadside) 1.5 M(Vehicle)
Required Beam Pattern	10

1.5 Conclusion:

Smart antennas can substantially enhance the overall performance of Wi-Fi communication structures utilized in its. Smart antenna era presents variety extension, increased data charge, higher community capability and higher carrier excellent. But, clever antenna represents many specific methods of the usage of a couple of antennas on one or both ends of the Wi-Fi link. Moreover, the paper suggests that the antenna can exchange the radiation sample, by way of adjusting simplest the load of detail beams used for street conversation, which leads to simplifying and dashing up the beam control procedure. This paper also highlights the data transmission principle by smart antenna.

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