IMPULSE HIT

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Vision

IMPULSE HIT is a yearly newsletter to share upcoming technologies in various fields of Electronics & Communication Engineering. This issue of newsletter introduced the upcoming research topics in the fields of smart antenna system, wireless communication as well as speech processing. These brief technical articles will influence many students and faculty members to extend research works in these fields in near future.

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Smart Antenna System
**Rahul Kumar, 4th Year, ECE**

The Communication between the moving people by radio signal was first demonstrated by Marconi in the year 1897. In the beginning the growth of the wireless communication was slow till the development of the cellular concept by Bell's laboratories in 1960s. By developing highly reliable, miniature, solid-state radio frequency hardwares it was possible to provide wireless communications to an entire population. Pagers, cordless telephones, cellular telephones are the examples of the wireless radio systems. In the recent days the cellular radio communication is in demand. The performance of the wireless communication systems are limited by the mobile radio channels. The mobile radio wave propagation in the line of sight path between transmitter and receiver can vary due to severe obstruction by the buildings, mountains and foliage etc. Multiple reflections from various objects lead to electromagnetic wave propagation in different paths of the different lengths. The interaction between these waves causes multipath fading at a specific location. Basically in the urban areas the radio waves reflect from the ground and surrounding structures. So the incoming radio waves arrive from different directions with different propagation delays. At any point in the space the signal received by a mobile consists of a large number of plane waves having randomly distributed amplitudes, phases and angles of arrival. The multipath components are combined vectorially at the receiver antenna and make the received signal distorted.

To improve the performance of the high speed wireless communication it is necessary to separate the desired signal or the line of sight signal from the delayed or interfering signal and also to minimize the co-channel interference. To achieve these goals the smart antenna system has been developed.

To reduce the multipath fading and co-channel interference effectively, the smart antenna system is the most promising technology. By focusing the radiation pattern in the desired direction the smart antenna system can achieve the goal. Smart antennas employ a set of radiating elements arranged in the form of an array. The switchable or movable beam pattern which follows the desired user is formed by combining the signals from each array element. The arrays incorporated in the smart antenna system are not smart; the digital signal processing makes them smart. The technique of combining the signals from each antenna element and then focusing the radiation pattern in a particular direction is often referred to as digital beam forming. The realization of the smart antenna is often done with the switched beam system or fully adaptive array. A smart antenna system consists of an antenna array, RF hardware, and a computer controller. The directional pattern which is formed by the antenna array can changes it directionality according to the radio frequency environment in order to improve the performance of high speed wireless communication, this function of the system is made by the computer controller. The simplest form of the smart antenna is the switched beam antenna system. The switched beam antenna system generates several overlapping fixed beam. The appropriate pattern is selected for any given set of conditions. The adaptive array can dynamically change its pattern according to the RF environment; this can be achieved by varying the phase of exciting current at each radiating element to optimize the pattern. Smart or adaptive antenna is being considered for use in wireless communication systems. Smart

antennas can increase the coverage and capacity of a system. In multipath channels the smart antenna system can increase the maximum data rate and can minimize the fading by rejecting the multipath components. The most important advantage of the smart antenna system is the higher network capacity, makes capable to serve more users per base station, thus increasing revenues of network operators and the probability of blocked or dropped calls is also be minimized. Also, the transmission quality can be improved by increasing desired signal power and reducing interference.

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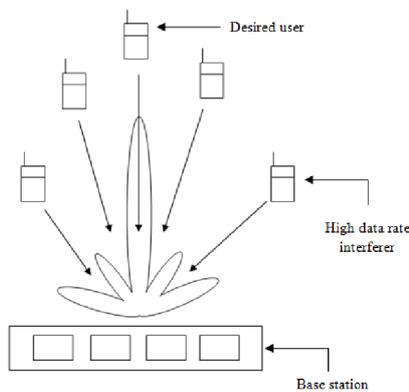
Smart antenna patterns in a cellular system with high data rate interferers and desired low data rate users.

The figure shows the typical smart antenna pattern in the RF traffic environment. The smart antenna system is employed in the base station. The cell consists of several users. The smart antenna system directs its pattern to the desired user and broad side nulls to the interfering users as shown in the figure above. The high data rate users are considered as the interferer in this case. By the above mentioned technique the smart antenna system can reject the interfering signal and improve the quality of communication to the user under consideration.

Use of Speech Technology to Detect Parkinson Disease

Arpita Sagar, 3rd, ECE

The application of science and engineering for the development of humanity and society is always the first priority of research. The concept of signal processing is already a reputed practice to analyze ECG, EEG, MRI, etc. But the latest one is the application of speech processing to detect the neurological disease. It has been a motivation of speech researchers in the recent past. It is difficult to detect the disease in the early stage as it slowly starts to affect the human body. The symptoms of PD usually involve movement impairment, irresistible shaking, difficulty walking. As the disease progresses, cognitive and behavioral changes may arise. According to the literature, voice degradation may be one of the first noticeable symptoms of PD. The early detection of the disease would make it possible to prevent further progression. As per the scientists, in the early stage dysarthria occur frequently in PD. Dysarthria causes reduced speech intelligibility, articulatory and phonatory impairment. By observing the certain parametric changes (phonetical, prosody, etc.) of the speech signal, we can identify the disease.

PD is a neurodegenerative brain disorder that progressively affects the nervous system and causes a large number of symptoms in the patient body. Patients suffer from PD experience changes in cognition and language which make them difficult to think quickly or to understand complex sentences. Speech also becomes soften and monotonous. Full treatment of this disease does not exist but early detection can help the patient to avail early treatment. Parkinson is now a very common disease and approximately 6.3 million people are

affected globally. A proper early diagnosis can improve patient's condition and might able to communicate clearly and loudly with more emphatic facial expression.

Early researches on this have shown promising performance to detect PD by using of speech technology. Parkinson disease progressively affects the total voice production system including vocal-tract dysfunction, disorder in larynx and also hyper nasality. Hence, the exact knowledge of symptoms at different stages can help to build a proper diagnosis system.

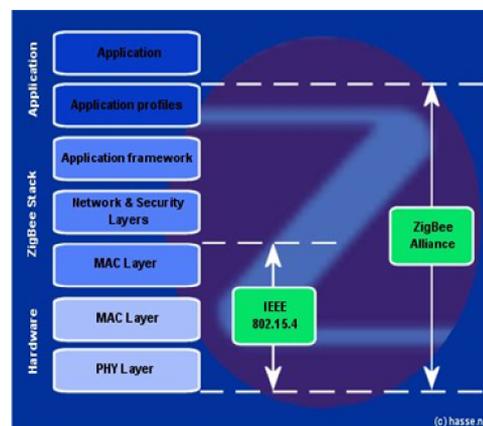## ZIGBEE

Suman Paul, Assistant Professor, ECE

The concept of Zigbee is associated with controlling of all electronic devices and communicating with themselves in the surrounding environment with the help of simply our mobile or PC by using this latest technology .The serious problem of more cables for physical connection among devices which is solved by this wireless technique.

Zigbee is a set of specifications built around the IEEE 802.15.4 wireless protocol for peer to peer communication. Zigbee devices are limited to a through-rate of 250kbps, operating on the 2.4GHZ ISM band, which is available throughout most of the world. This transmits commands and receives commands from other electronic devices. This can connect up to 65,553 devices per unit .The important feature of Zigbee is providing with both memory and logical unit. This helps in facilitating independent decisions by itself with need of coordinator, which help in sensing the devices .There are technologies which already available in the market like Blue tooth (IEEE 802.15.1)

.There are some ensured aspects which lead to the development of Zigbee. It has major advantage of low power consumption (of almost 30mw). Other advantages that it provides are high security to all electronic devices, other than being economical. This can serve all purposes in industries and domestic appliances. It is very simple to be operated by everyone, making it more users friendly.

ZigBee is the name of a wireless oriented specification for high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for wireless personal area networks (WPANs).

ZigBee operates in the industrial, scientific and medical (ISM) radio bands; which is 868 MHz in Europe, 915 MHz in the USA and 2.4 GHz in most jurisdictions worldwide. The technology is intended to be simpler and cheaper than other WPANs such as Bluetooth. The most capable ZigBee node type is said to require only about 10% of the software of a typical Bluetooth or Wireless Internet node, while the simplest nodes are about 2%. However, actual code sizes are much higher, more like 50% of Bluetooth code size. ZigBee chip vendors have announced 128-kilobyte devices.

Layers in Zigbee

The layers shown in the figure are the ZigBee standard. Many aspect of the network are specified in this layer, like: Application profiles, security settings and the messaging. ZigBee is known because of its mesh network architecture but it does also support a star topology or cluster tree or hybrid architecture. Depending on the application or situation each kind of topology has its own advantages and disadvantages.

A star topology is very simple, all nodes directly communicate with one central node (like a star). The mesh topology is more complicated, each node may communicate with any other node within range. It's easy to understand that this gives many possible routes through the network; this makes it a very robust topology because bad performing routes can be ignored. The cluster tree topology is basically a combination of star and mesh.

of traffic. **Dijkstra's least-weight path** algorithm is used to compute the anchor of the path. A dynamically rated map is a map that is generated based on the real-time traffic condition on the roads. Road-side deployment units can monitor the city traffic condition and distribute this information to every vehicle. Thus, the difference between a statically rated map and a dynamically rated map is accuracy of road traffic; while a statically rated map is based on bus routes that typically have high traffic volume; a dynamically rated map is based on the traffic monitored dynamically by road-side units. A-STAR also proposes a different recovery algorithm when the packet gets stuck due to disconnectivity of the current path to the destination. The mobility model and propagation model are based on the M-Grid mobility model, a variant of the Manhattan model that considers not only the vehicular movement in a typical metropolis where streets are set out on a grid pattern but also the radio obstacles.

Anchor-Based Street and Traffic Aware Routing (A-STAR) in VANET

Aditi, 2nd Year, ECE

Anchor-Based Street and Traffic Aware Routing (A-STAR) is similar to GSR (Geographic Source Routing) in that packets are routed through anchor points of the overlay. However, A-STAR is traffic aware: the traffic on the road determines whether the anchor points of the road will be considered in the shortest path. A-STAR routes based on two kinds of overlaid maps: a statically rated map and a dynamically rated map. A statistically rated map is a graph that displays bus routes that typically imply stable amount