SMART ANTENNAS FOR MOBILE COMMUNICATION
Smart antennas in mobile communications that enhances the capabilities of the mobile and cellular system such as

- Faster bit rate.
- Multi use interference.
- Space division multiplexing (SDMA).
- Adaptive SDMA.
- Increase in range.
- Multipath mitigation.
- Decreased inter symbol interference.
- Best suitability of multi-carrier modulations such as OFDMA.
- Decreased co-channel interference and adjacent channel
A smart antenna system combines an antenna array with a digital signal-processing capability to transmit and receive in an adaptive, spatially sensitive manner.

Such a configuration dramatically enhances the capacity of a wireless link through a combination of diversity gain, array gain and interference suppression.
An example for smart antenna system
The following are distinctions between the two major categories of smart antennas regarding the choices in transmit strategy:

- **Switched Beam**: A finite number of fixed, predefined patterns or combining strategies (sectors).
- **Adaptive Array**: An infinite number of patterns (scenario-based) that are adjusted in real time.
Switched beam antenna systems form multiple fixed beams with heightened sensitivity in particular directions.

These antenna systems detect signal strength, choose from one of several predetermined, fixed beams.

Switch from one beam to another as the mobile moves throughout the sector.

Switched beam systems combine the outputs of multiple antennas in such a way as to form finely sectorized (directional) beams with more spatial selectivity.
SWITCHED BEAM ANTENNAS
ADAPTIVE BEAM ANTENNAS

- The adaptive system takes advantage of its ability to effectively locate and track various types of signals to dynamically minimize interference and maximize intended signal reception.

- Adaptive system provides optimal gain while simultaneously identifying, tracking, and minimizing interfering signals.

- A representative depiction of a main lobe extending toward a user with a null directed toward a co-channel interferer as shown:
WHAT IS A SMART ANTENNA SYSTEM
TYPES OF SMART ANTENNA SYSTEM
RELATIVE BENEFITS/TRADEOFFS OF SWITCHED BEAM AND
DISCUSSIONS
CONCLUSION
GRATITUDE
WHAT MAKES THEM SO SMART

- Their smarts reside in their digital signal-processing facilities.
- Digital format for manipulating the RF data offers numerous advantages in terms of accuracy and flexibility of operation.
- They capture, convert, and modulate analog signals for transmission as digital signals and reconvert them to analog information on the other end.
GOALS OF A SMART ANTENNA

The dual purpose of a smart antenna system is to augment the signal quality of the radio-based system through more focused transmission of radio signals while enhancing capacity through increased frequency reuse.

- Signal Gain.
- Interference Rejection.
- Spatial Diversity.
- SDMA.
- Power Efficiency.
**Benefits**

- Better Range / Coverage.
- Increased Capacity.
- Multipath Rejection.
- Reduced Expense.
- Can adapt the frequency allocation.
Each approach forms a main lobe toward individual users. It attempts to reject interference or noise from outside of the main lobe.
Switched beam is an extension of the current microcellular or cellular sectorization method of splitting a typical cell. It further subdivides macro-sectors into several microsectors as a means of improving range and capacity. Each micro-sector contains a predetermined fixed beam pattern.
SWITCHED BEAM SYSTEM

Switched Strategy
Adaptive antenna technology can dynamically alter the signal patterns to near infinity to optimize the performance of the wireless system.

Adaptive arrays utilize sophisticated signal-processing algorithms.
ADAPTIVE ANTENNA SYSTEMS

Adaptive Strategy

PRIYANKA
How do Smart Antenna Systems work?

Switched Beam System

Adaptive Antenna Systems

PRIYANKA
Integration
Range / Coverage
Interference Suppression
Adaptive Beam Forming and Algorithms
Spatial Structure Methods
Adaptive Antennas
Spatial Division Multiple Access (SDMA)
Adaptive Beam Forming and Algorithms
SPATIAL DIVISION MULTIPLE ACCESS

Integration

It locate and track fixed or mobile terminals, adaptively steering transmission signals toward users and away from interferers.

Achieves superior levels of interference suppression.

More efficient reuse of frequencies.

The scheme can adapt the frequency allocations to where the most users are located.

The power is divided among the elements

The power to each element is reduced because the energy is being delivered directionally.
Advantages of SDMA

- Reduction in network-wide RF pollution.
- Reduction in power amplifier size.
Adaptive antennas (AAs) are an array of antennas. It is able to change its antenna pattern dynamically to adjust to noise, interference and multipath. Confine the broadcast energy to a narrow beam. AAs are used to enhance received signals and may also be used to form beams for transmission.
INTRODUCTION
SMART ANTENNA
GOALS OF A SMART ANTENNA SYSTEM
ARCHITECTURE OF SMART ANTENNA SYSTEM
RELATIVE BENEFITS/TRADEOFFS OF SWITCHED BEAM AND
DISCUSSIONS
CONCLUSION
GRATITUDE

Spatial Division Multiple Access
Adaptive Antennas
DISCUSSIONS AND FUTURE SCOPES

- Use of smart antenna in existing systems will reduce power consumption and interference.

- Enhancing spectral density in wireless system.

- Less RF pollution is created with the use of smart / adaptive antenna.

- Once nanotechnology antenna arrays are developed, it will be possible to incorporate smart antenna at handheld system too.
CONCLUSION

- As the system uses a DSP processor the signals can be processed digitally and the performance with a high data rate transmission and good reduction of mutual signal interference.

- The narrow beams get rid of interference, allowing many users to be connected with in the same cell at the same time using the same frequencies and can adapt the frequency allocation to where the most users are located.
THANK YOU

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