



# Automation Control of Antenna and Microwave in Telecom Towers using SCADA

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## ABSTRACT

*Telecommunications companies worldwide have been attempting to cover the largest demand areas with better services and lower costs, and one of the main factors to try is the best distribution of antennas. Cell phone use is increasing in developing countries, where services include installing cell towers in residential areas and in people's homes to provide the best coverage for cellular phone users. If there is a problem with cell towers, the technicians will climb the tower and solve the problem. Mechanical tilt and azimuth (director orientation) of antenna changes, the position of change of microphones due to natural disasters, and other technical reasons are major problems in telecom towers. To date, no service provider can know exactly why the antenna and microphone problems occur if customers only make complaints. A highly important objective of this theological study is Changes the orientation of automation and micro by the implementation interface of SCADA (supervisory control and data acquisitions) to eradicate the harm caused to humans (technicians) by climbing the tower. The popularity of SCADA systems, including controlled applications, is increasing. The distributed process is a thing for these processes in different places where controlled surroundings are scattered.*

**KEYWORDS:**Antenna, SCADA, Microphone, Angle rotation,cell phone towers

## 1. INTRODUCTION

The rapid development of worldwide telecommunications systems is bound to live in a dynamic system. As one of the main components of this system, telecommunications sector services will therefore be influenced by dynamics. The main challenge in the telecommunications industry is building an efficient network. One of the most complex decisions in the telecommunications industry is

selecting the optimal wireless tower sites. The primary goals are to cover the highest demand area with low-cost good signal quality, and an internal goal is to reduce compression decision-making time. Intelligent antenna technology is one of the most advantageous technologies in wireless and mobile communications, and it must be noted that two factors, such as multipath interference and co-channel interference, restrict the capacity and execution. When a signal is transmitted,

multiple reflections are carried out from different obstacles or objects, such as trees, mountains, etc. Due to this multipath, we have several copies at the receiver of the same signal from various directions with different periods. The smart antennas we have discussed are nothing other than the array antennas. I.e., SCADA is a system that collects data from different sensors in a plant, or elsewhere and sends it to the central computer, which then manages and controls the data. Since it controls most of our goods, SCADA and other control systems have been so important. Conventional SCADA communication has been point-to-multifunctional in-line or private radio communications technology has been used more and more in SCADA communications with the advent of the Internet Protocol (IP). The connectivity gives SCADA a wider scale to give access, alarm, trends, and reporting from remote devices to real-time data display.

**2. HISTORY OF PLC TECHNOLOGY:**

PLC technology is a good and strong alternative to other communication technologies like frequency because of its cost-effectiveness, which is related to the dual use of power wires to carry both electrical power and data (RF). Despite its reputation as a rugged environment created without communication in mind, the PLC channel remains a formidable competitor to the wireless network for applications like home automation, smart grid, smart city, and even telemetry. PLC has applications in in-vehicle communications, in-aircraftcommunications, in-ship communications, and in-train communications, to name a few . In the last three to four years, PLC has been investigated as a backbone network for a variety of other communication technologies, including visible light communications (VLC). It can also serve as a backbone for near-field communications (NFC), which is still in the early stages of development.

Remote power supply metering was proposed by Edward Davy in 1838 [1, 2]. In contrast, the history of analogue PLC dates to 1918, when power line voice communication was widely promoted until the early 1930s [3, 4]. At a frequency of roughly 130 kHz and a rate of 10 kbps, the first generation of digital transmissions across power lines took place [5]. Broadband PLC (BB-PLC) technology was established

in 1990, allowing transmission at a high data rate of up to 10 Mbps using frequencies between 2 and 30 MHz and orthogonal frequency division multiplexing (OFDM). The evolution of PLC technology is detailed from 1838 to the present.

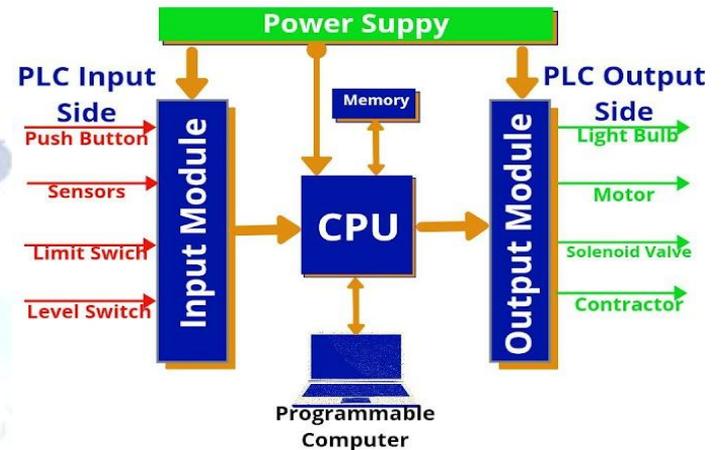


Figure: 1. Block diagram of PLC

**3. SCADA TRADITIONAL SETUP:**

Setup of a Traditional SCADA System SCADA gathers data, sends it to a central location, does any necessary analysis and control, and then displays it on several operator screens. Actions and the automation process are controlled automatically by systems. Previously, relay logic was used to control production and plant systems. After the discovery of the CPU and other electronic devices, manufacturers began incorporating digital electronics into relay logic equipment. The most widely used control systems in the business are PLCs or programmed logic controllers. As the need to monitor and handle additional equipment in the plant grew, PLCs were dispersed, and the systems became more intelligent and smaller in size. Distributed control systems (DCSs) and programmable logic controllers (PLCs) are used.

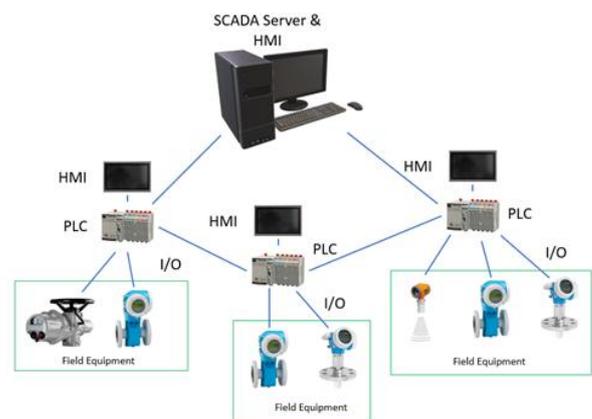


Figure: 2. Block diagram of SCADA

SCADA Functions The essential functions of a supervisory control and data acquisition (SCADA) system are as follows: The phrase "human-machine interface" (HMI) refers to a system that allows people to interact with machines (HMI). 1.Using electricity to communicate 2. Data acquisition (DAQ)3. Be observant. 4. Remain in command. The data gathering process includes processes such as data collection, storage, and retrieval. 5. Carry out a calculation.6. Create a report.

**4. MECHANICAL TILT:**

Uptilt refers to a tilt applied above, whereas down tilt refers to a tilt applied downwards. The figure depicts the downward tilt. The down tilt is the most advantageous, and this has been considered throughout our discussion. The horizontal beam, not the vertical beam, will be the subject of our discussion. Down tilting the antenna mechanically or manually is referred to as mechanical tilt. Later, this type has several disadvantages. Electrical tilt was devised by Radio frequency and system engineers because of these disadvantages. Electrical tilt modifies the phases of the emission pattern of individual antennas in a sector array antenna without causing any physical movement. Electrical tilt can also provide the gain needed to support the beam forming idea, which extends coverage.

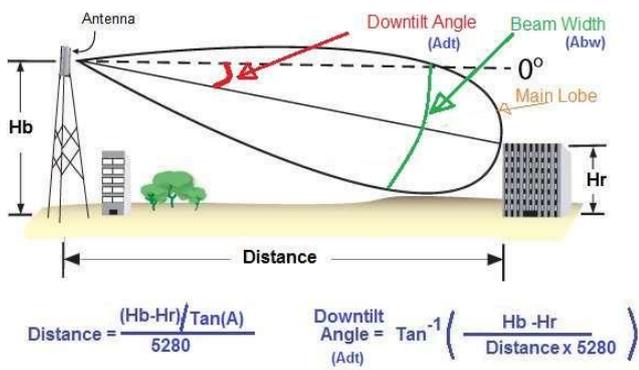


Figure:3. Diagram of Mechanical Tilt

**5. AZIMUTH ANGLE :**

The azimuth angle is the compass direction from which the sunlight is coming. With North = 0° and South = 180°, the azimuth angle is like a compass direction. Other publications use slightly different definitions (for example, angles of 180° and South equals 0°).

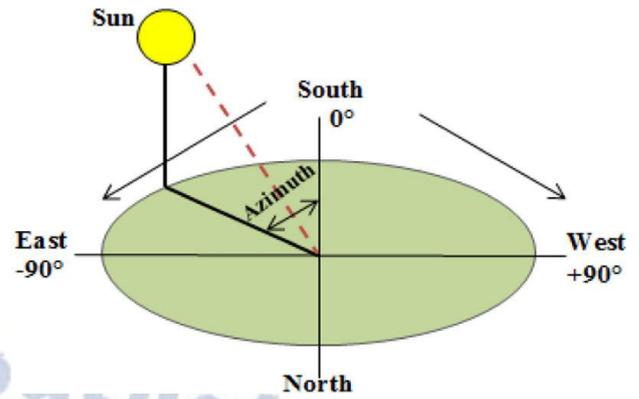


Figure:4. Azimuth angle diagram

**6. ANTENNA AND MICRO:**

A microcontroller is a small computer that fits on a single integrated circuit chip made of metal oxide semiconductors. A microcontroller is an electronic device that has one or more CPUs, memory, and programmable input and output peripherals. A microcontroller (MCU for microcontroller unit) is a small computer that is constructed from a single MOS integrated circuit (IC) chip. A microcontroller is a computer with one or more CPU cores, memory, and programmable input and output peripherals. A directional antenna, also known as a beam antenna, is an antenna that radiates or receives more power in specified directions, allowing for improved performance and fewer unwanted sources of interference.



Figure: 5. Antenna and Micro

**7. LINE OF THE SITE IN ANTENNA:**

A clean passage between antennas, known as the radio line of sight, is required for radio transmission. The direct free-space path between two places is known as the line of sight. On a clear day, you may simply check

if a visual line of sight exists between two sites that are kilometers apart using binoculars.

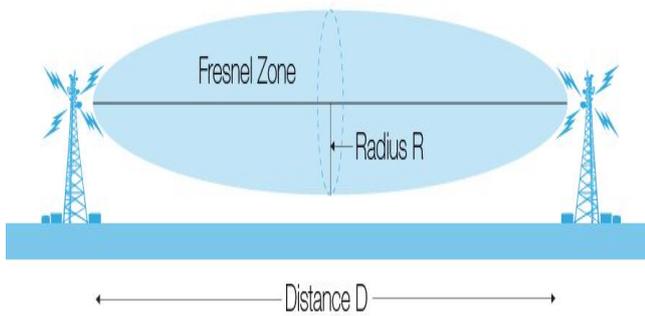


Figure: 6. Line of the site in Antenna

### 8. INDUSTRIAL AUTOMATION:

Industrial automation refers to the use of control systems, such as computers or robots, and information technology, to handle a variety of processes and types of machinery in an industry to replace human beings. It is the next step in the industrialization process after mechanization. The term "automation" refers to a group of technologies that eliminate the need for humans to intervene in processes. Predetermining decision criteria, subprocess links, and related activities and embedding those predeterminations in computers reduces human intervention.

### 9. DATA ACQUISITION SYSTEM:

A data acquisition system is a set of software and hardware that lets you measure and manipulate the physical properties of real-world objects. A full data acquisition system consists of DAQ (data acquisition) hardware, sensors and actuators, signal conditioning hardware, and a computer running DAQ software. The most prevalent sort of data collection system is the DAQ system.

1. Information gathering
2. Programmable logic controllers (PLCs)
3. Software for data collection
4. Multifunction Analog Input Cards and Boards
5. Number six is Analog Output Cards and Boards.
6. Digital I/O, as well as counter/timer cards and boards.
7. Number eight on the list is Communication Cards and Boards.

### 10. OBJECTIVE OF THE PROJECT:

True technology is all about completing a task while avoiding mishaps and maintaining the comforts and sophistication that the activity requires. This thesis is the result of the aforesaid intention. To recognise and resolve antenna and microwave position and orientation changes in telecommunication towers using industrial automation and the SCADA interface.

### 11. METHODOLOGY:

Telecommunication is the transmission of data using a variety of technologies across the wire, radio, optical, or other electromagnetic networks. Its origins can be traced back to humans' need for communication over a longer distance than is possible with the human voice, yet on a similar scale of expediency, so slow systems are ruled out.

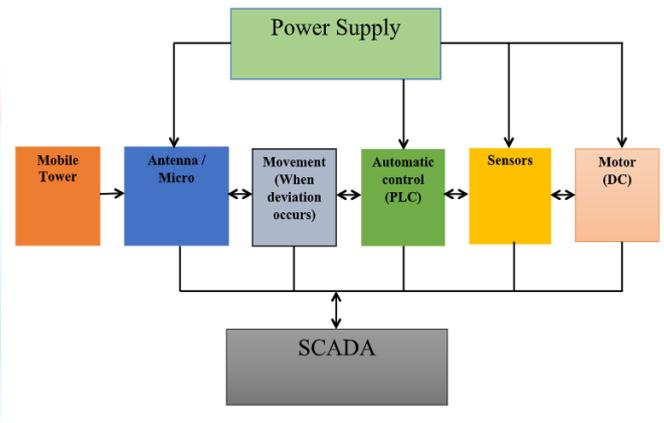


Figure:7. Block diagram of telecommunication tower

#### 11.1 Worm gear mechanism:

A worm gear has a spiral threaded shaft that engages and drives a toothed wheel. Worm gears are an older type of gear that is a variation of one of the six basic machines. A worm gear is just a screw pressed against a spur gear with slightly slanted and curved teeth that looks like a conventional spur gear. The worm's position on the worm wheel, which varies the rotational movement by 90 degrees, also affects the plane of movement (or simply "the wheel"). The most frequent components are a steel worm and a brass wheel.

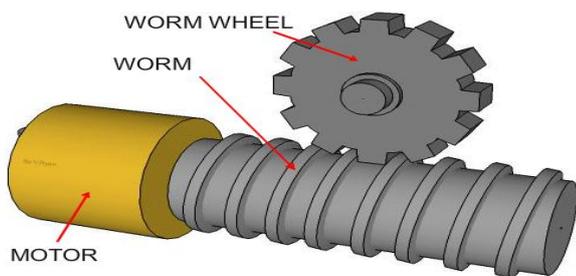


Figure: 8. Worm Gear Mechanism

### 11.2 General sensor:

A high-frequency magnetic field is produced by coil L in the oscillation circuit. When a target meets a magnetic field, electromagnetic induction causes an induction current (eddy current) to flow. As the target gets closer to the sensor, the induction current flow increases, putting more strain on the oscillation circuit. After that, the oscillation slows or stops. The sensor detects this change in oscillation state and outputs a detection signal using the amplitude detecting circuit.

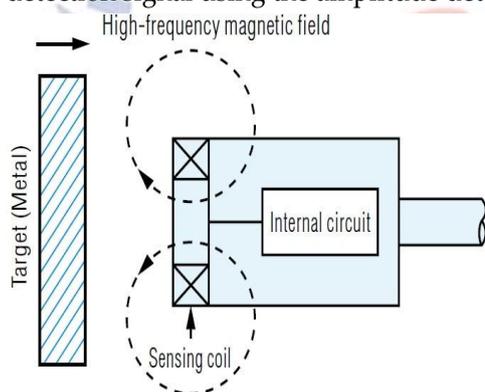


Figure:10. General sensor

### 11.3 Inductive proximity sensor:

An inductive proximity sensor is a non-contact electrical proximity sensor. It's used to find and detect metal objects. The detecting range of an inductive switch is determined by the type of metal detected. The sensor is made comprised of an induction loop or detection coil. Inductive proximity sensors measure magnetic loss induced by eddy currents created on a conductive surface by an external magnetic field. An AC magnetic field is generated on the detecting coil, and variations in impedance due to eddy currents generated on a metallic item are monitored.

### 12. PROBLEMS ON CELL TOWERS:

Climbing cell towers is considered one of the most dangerous jobs in the country. Climbers working on cell towers run the risk of serious injuries, some of

which are fatal. Injured workers may be entitled to workers' compensation and other forms of financial relief if the cause of the workplace accident was the employer's lack of workplace safety. Workers who have been hurt on the job or surviving family members whose loved one has died because of work-related injuries should contact a Pitt County lawyer.

### 13. CELL PHONE TOWER DANGERS

Cell towers can range in height from 100 to over 1000 feet. Many of the injuries that occur, including some that are fatal, are caused by falling. Workers who mount cell towers, on the other hand, face a plethora of other risks: 1. Electrocution 2. Inadequate protective equipment 3. Excessive wind, rain, snow, or lightning are examples of weather-related consequences. 4. Objects that are rapidly falling Cellphone providers may place a premium on quickly increasing their coverage due to the extensive use of cell phones and the resulting necessity for larger cellular networks. To fulfil deadlines, it may be necessary to disregard all cell tower safety measures, either purposefully or unintentionally. As a result, cell tower owners may be able to: 1. They have a feeling of being overworked. 2. They don't get enough sleep. 3. You do not have access to the appropriate safety and protective gear. 4. They haven't received adequate instruction. There is an excess of examples of how dangerous working on a cell tower can be. While attempting to replace a boom on the tower with three coworkers in 2019, a 28-year-old man working on a cell tower in Kentucky was killed and left suspended 240 feet in the air. In another incidence, five cell tower climbers were killed in Florida in 2015 after their pickup truck was struck by another vehicle whose driver failed to stop at a stop sign while on the job.

### 14. ANSWER TO THE HORIZON:

Unmanned aerial systems (also known as "smart lanyards") and digital tie-off solutions (also known as "smart lanyards") are two important inventions that are claimed to help preserve tower climbers' safety. In the former, drones are said to be employed to do maintenance jobs at vast heights, which is a far-fetched notion. The latter method looks to track and/or handle tie-off points and events using a smart system. The FCC did not go into detail about this technology in their

workshop with OSHA and NATE, but patents for a digital tie-off system are currently being developed. This may make ground-level supervision of workers' actions easier, in addition to empowering people to follow established protocol (preventing them from "free climbing," which has been a significant issue among tower climbing's most vocal critics). Telecommunications technology has a big impact on our lives nowadays. These workers risk (and usually lose) their lives for it to grow. Workers require permission to cease work in harmful settings because company foremen should not be anticipated or trusted to do so. While new technology has the potential to enable people to work in secure surroundings, it can also supplant or replace human labor. However, how we treat our workers in the meantime reveals how much we respect labor and the human beings that make up what's left of our working class.

#### 15.SUMMRAY:

My dissertation was about little prototypes. When external forces were applied, changes in the antenna (mechanical tilt and azimuth) were made and resolved without the need for human intervention but owing to a lack of resources and financial assistance, I was unable to test them in a practical manner.

#### 16.CONCLUSION:

1. In the revenue-declining era that the telecom industry is experiencing, particularly in mobile telephony, there are numerous options for a wireless operator with a large tower park to generate additional profits. These new profits would be welcomed by shareholders. However, the separation of infrastructure and service industries appears to be unavoidable and is likely still in its early stages.
2. In both fixed and mobile telecommunications, more refund infrastructure separation is increasingly viewed as climbing up the network playthrough passive as well as active elements, and as a result, an entire transformation of the traditional telecom landscape as we know it can be expected in the medium term.
3. No one should be allowed to climb the tower if the power at the base of the antenna exceeds 500 watts.

It is generally safe if the power is less than 200 watts.x

#### Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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