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SATELLITE TRACKING SYSTEM

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Abstract

Satellites in nominally geostationary orbits possess diurnal motion which reasons the plain function of the spacecraft .The motion of the satellite tv for pc consequently must be tracked through the earth station antenna. This mission simulates the overall performance of satellite via measuring the parameters including Azimuth perspective, Elevation attitude, apogee, perigee inclination of orbital plane to equatorial plane, argument of ascending node, argument of periapsis, etc. Satellite revolving in the earth produces a beacon signal which is taken by the antenna, by this beacon signal the antenna understands where the satellite is residing in earth's atmosphere. This is called as tracking of satellite by antenna of base station. In addition the project is working in step tracking mode means similar to the operation of the manual tracking scheme except that a small computer is used to perform the functions of the operator.

INTRODUCTION

Satellite Communication is a kind of Microwave communication with a repeater placed in space. A Communication Satellite (also referred to as COMSAT) is an artificial satellite stationed in space for the purpose of telecommunications. Satellite Communication does not compete with but complements the terrestrial modes of communication like Optical Fiber and Microwave communication. Modern communication satellites use a variety of orbits including geostationary orbits, Molniya orbits, other elliptical orbits and low (polar and non-polar) Earth orbits.

For fixed (*point-to-point*) services, communications satellites provide a microwave radio relay technology complementary to that of submarine communication cables.

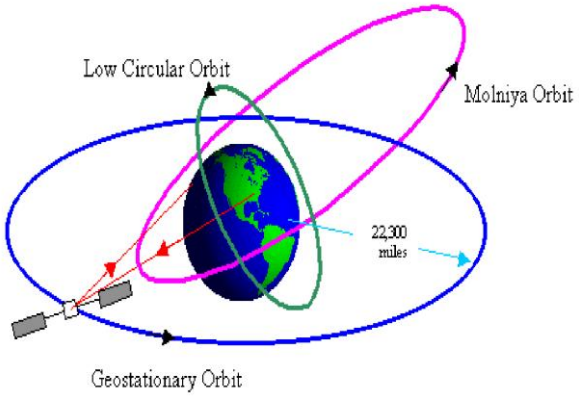

***Fig: 1.1** Earth surrounding different orbits*

They are extensively utilized for cellular applications including communications to ships, vehicles, planes and hand-held terminals and for tv and radio

broadcasting, for which packages of different technologies, which include cable, is impractical or not possible.

NEED OF TRACKING

While revolving around the earth satellite should not go away from its orbit and stay within the line of sight .For these purpose it is necessary to track the satellite in some interval of time to maintain the communication between the satellite and earth station If the satellite goes away from the line of sight it may affect the communication between the earth station control unit.

EXISTING SYSTEM

Satellite tracking is completed by ground station antennas which provide most important data about the position of the satellite and the orbit of satellite in space.
Inside the current system the antenna control system is driven manually by the operator for tracking the satellite. This system requires update of look angles of the antenna which needs to be entered manually in to antenna control machine and there's also need of the operator to look over that machine. That is the downside of current satellite gadget.

PROPOSED SYSTEM

Different Functions Of Antenna Control System are listed below

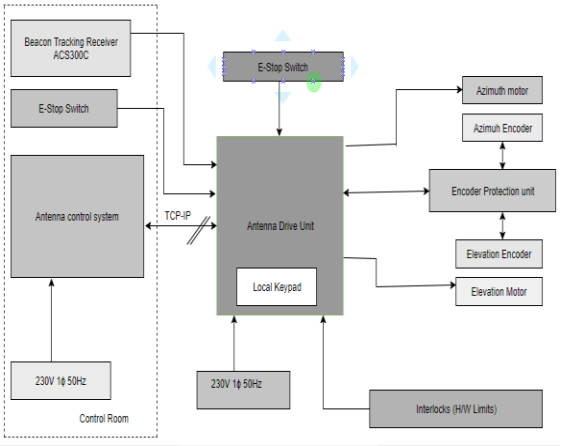

Fig 1.2 : *System Block Diagram of Antenna Control System*

Beacon Receiver Configuration:

Beacon signal configuration is used to control & monitoring of Beacon Tracking Receiver's Frequency & gain.

Antenna control system:

The ACU003 antenna control system is an antenna controller / positioner with optional satellite tracking support.

Antenna drive unit:

ADU is mainly used to control 3- phase motor, which drives the antenna. The control of ACU to the antenna is also realized by ADU.

Azimuth Motor:

Azimuth motor is used to move the antenna in Azimuth direction i.e. in horizontal direction.

Elevation Motor:

Elevation Motor is used to move the antenna in Elevation direction i.e. in vertical direction.

Azimuth & Elevation Encoder:

This encoder is used to monitor the operation of Azimuth & Elevation motor. By using this we can adjust the time duration and speed.

Power Supply:

230V one phase 50 Hz power supply is used in Antenna Control System.

METHODOLOGY

STEP TRACK MODE

The antenna is getting tracked in step track mode as per two criteria. In the ACU (Industrial PC Unit), tracking interval period has been fixed as 30 minutes. Also, the threshold signals strength voltage 5.9999 volt and the peak reference voltage is kept as 7.7 volt.

The antenna gets tracked in every 30 minutes interval for peak signal strength or whenever the signal strength voltage reaches below the threshold voltage i.e., below 6v. When the signal strength voltage reaches on or above the peak reference value, i.e., 7.7v, the tracking

stops and waits till the signal strength value goes below 7.7v.

PROGRAM DESIGN AND IMPLEMENTATION

GUIs(Graphical User Interface provide point-and-click on control of software program applications, doing away with the want to study a language or kind commands for you to run the utility MATLAB apps are self-contained MATLAB packages with GUI the front ends that automate a challenge or calculation. The GUI typically contains controls along with menus, toolbars, buttons, and sliders. Many MATLAB merchandise, together with Curve fitting Toolbox, sign Processing Toolbox, and manipulate device Toolbox include apps with custom person interfaces.

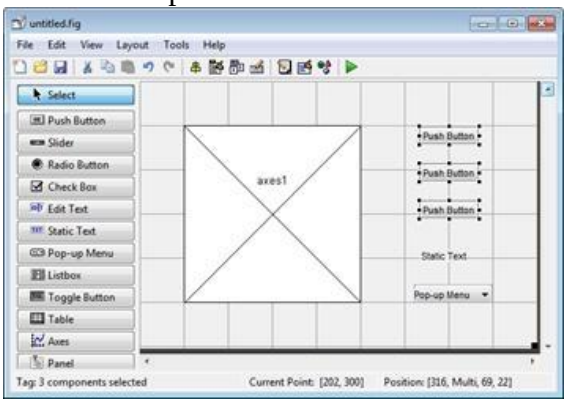

Fig 1.3: *GUIDE layout Editor*

GUIDE (GUI development environment) provides tools to design user interfaces for custom apps. Using the GUIDE Layout Editor, we can graphically design our UI. GUIDE then automatically generates the MATLAB code for constructing the UI.

SOFTWARFE DESIGNED

By implementing the project in Matlab software we have simulated the tracking program by showing different parameters like azimuth angle, elevation angle, apogee, perigee, inclination of orbital plane to equatorial plane, argument of ascending node and argument of periapsis.

The simulated output of satellite tracking is shown in Fig.1.4 below.

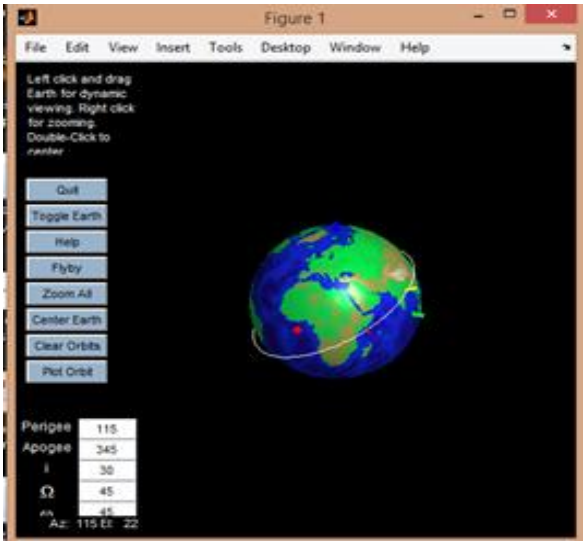

Fig 1.4: *Simulated output*

We have also plotted the orbit of satellite from its initial point and shown the different positions of satellite while revolving around the earth.
The discussion about the different measured parameters is listed below:

Apogee & Perigee

When a satellite is at its furthest point from the earth, it is at the apogee of the orbit. When a satellite is at its closest point to the earth, it is at the perigee of the orbit.

Argument of Perigee(ω)

The Argument of Perigee (w) is defined as the angle within the satellite orbit plane that is measured from the Ascending Node (W) to the perigee point (p) along the satellite's direction of travel. The value of the Argument of Perigee can be anywhere from 0 to 360 degrees.

Inclination Angle(i)

A satellite that orbits directly above the equator has zero inclination. If a satellite orbits from the North Pole to the South Pole, its inclination is 90 degrees. Orbital inclination is the angle between the plane of an orbit and the equator.

Right Ascension of Ascending Node (Ω)
The angle is measured eastwards (or, as seen from the north, counterclockwise) from the First Point of Aries to the node.

Azimuth Angle
Azimuth angle denotes the horizontal angle measured at the earth station antenna to north pole.

Elevation angle
EL means elevation angle required to track the satellite vertically.

OVERCOMING PROBLEM

For Bringing in the betterment in the existing system of satellite tracking the high quality tracking antennas can be used. The high quality antennas having stepper motors and better consistency and performance can be used. The software programming can be enhanced in the indoor unit for more accuracy of the antenna tracking.

For better communication through satellite system the use of the higher frequency spectrum bands i.e. the Ku and Ka bands rather than typical C band is proposed.

CONCLUSION

Above simulated result provides a brief idea of how we can measure the different parameters of satellite using Matlab software. As it is not based on real time system we have just configured the satellite tracking with the help of azimuth and elevation angle with respect to time.

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