Automatic Satellite Tracking for DTH

[1]Sandhya J.Dhanave, [2]Prof A.D.Harale

[1]PG Scholar, [2]Assistant Professor
[1]Department of Electronics Engineering,
[1] SKN Sinhgad College of Engineering,
Korti, Pandharpur – 413304.

Abstract : This project has been under taken to solve the problem of dish antenna installation for DTH (Direct to Home)at the remote place. The technology has advanced & with the help of 4G one can view the live telecast while moving but 4G network is not present everywhere. The proposed system will replace traditional dish antenna with a motorized and fully automated one. Where one just need to put desired satellite look-angle through the keypad provided and automatically the antenna will move to desired angle. Precise encoders are attached to the system so that it will give the angle measurement with one degree accuracy. Every satellite has different look angle from the same geo graphical position. One must know the Azimuth angle for desired satellite while operating the proposed system. These look angles are available on different websites free of cost.

IndexTerms **– DTH ,look -angle,4G,Encoders, Azimuth.**

I. INTRODUCTION

In India, Zee Network's first started the DTH service, known as Dish TV. Now there are almost seven DTH service providers in the market. Every service provider is using different satellites to provide service to the customer. Since individual dish is installed at every site it becomes difficult to track the desired satellite. While tracking the desired satellite, the installer must know the latitude and longitude of the site as well as the longitude of desired satellite. According to the available information the installer has to calculate azimuth (AZ) and elevation angle (EL). By calculating these angles the installer has to move his dish accordingly. Since the installer doesn't have all the technical instruments with him, he just installed his dish as per the direction of another installed dish. Because of the beam width of the satellite's transmitting antenna the customer may be able to see the picture, but it shows problems like the degraded quality of the picture and differed reception. In proposed system "Automatic Satellite Tracking" the role of the human is eliminated while tracking the satellite. In the proposed system the dish antenna will be provided with motors and some electronics control circuitry to check the movement of the antenna. The system supposed to be light weight so that it would be convenient to carry this system everywhere. Present automatic satellite tracking system are available with large size of motors and very complex electronic control circuitry. These type of system are not feasible to carrying vehicle because of size and weight of the system. Some of the system are lightweight and can be installed over the vehicle but the coast of the system is so high that in cannot be afforded by every DTH user. A typical satellite tracking system should be able to track the satellite without help of human. In this type of the dish is installed over the particular site and the installer has to put the electronic circuit associated with it in either step track or auto track mode. Both these methods are accurate but time consuming. Present satellite tracking system has Electronic control circuitry, motors, and encoders which gives the exact information about the position of the antenna. System may be close loop or open loop. So to eliminate above limitations of the present satellite tracking system there is proposed satellite tracking system**.**

Problems Related to DTH reception

1.Lack of Knowledge:

Normally the person who is installing the dish doesn't know which satellite he is going to track? Where it is located? What is look angle of that satellite from the particular location? Where the location is in line of sight to the dish?

2.Improper dish Selection:

Size of dish antenna varies with the satellite EIRP (Effective Isotropic Radiated Power). Greater the EIRP lesser is the size of antenna. One has to look for the satellite footprint before selecting the dish antenna. For the DTH antenna size varies from 30cm to 100cm.

3.Shadow Effect:

Location at which dish is to be installed, should not lie in shadow of a building or a tree. That will affect the signal quality.

4.Rain Attenuation:

DTH system are operating in Ku band, the strength of satellite signal may be reduced under sever rain condition. Rain attenuation increases as the signal frequency increases. This is due to wavelength of each frequency and size of the rain drop through which the signal has to pass. Any rain drop is path of either signal which approached half the wavelength in diameter will cause the attenuation.

Present Theories and Practices:

Presently Capacitive Coupling Element (CCE) antenna structures [1] are used for mobile satellite tracking system. As these antennas are light in weight and small in size, can be integrated or compatible with any existing satellite tracking system. These antennas are operating on lower UHF band. High gain mobile satellite antennas [2] can be making some improvement in the performance of the antenna control unit. These antennas are used in ship born system for navigation purpose. Wire antennas [3]

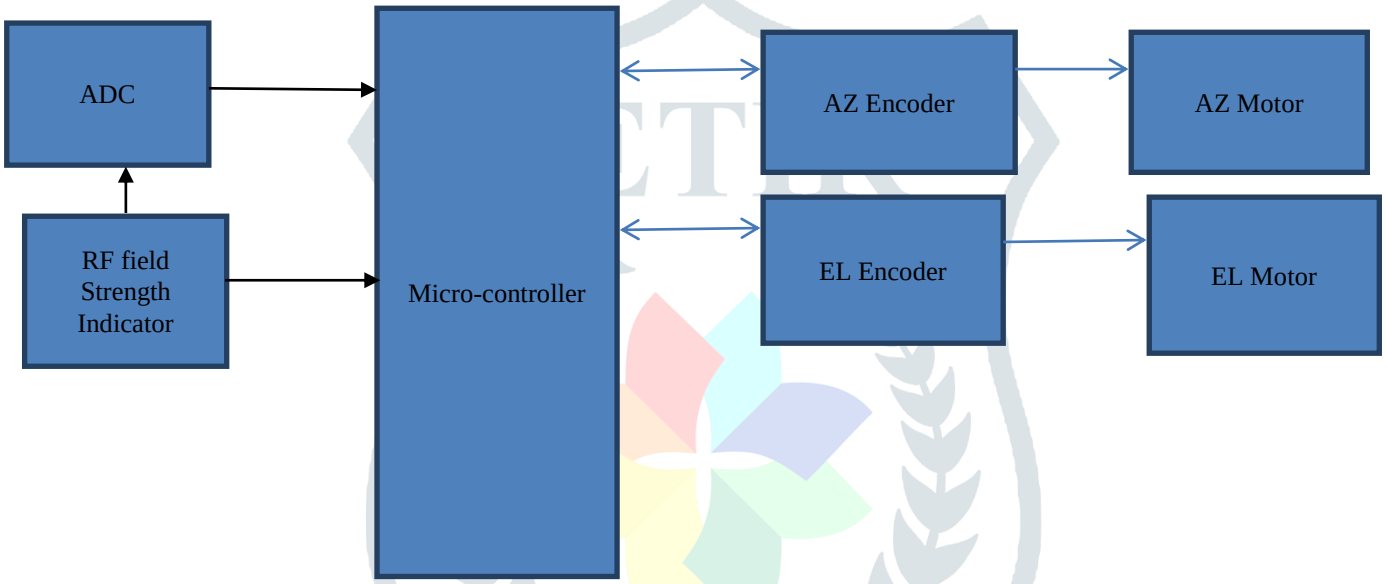
can be used for mobile satellite tracking The range for the wire antennas is low so they are used for Low Earth Orbit (LEO) Satellite applications. Gain provided by wire antenna is too low to use it for the DTH reception. Antenna tracking system can be implemented by using FTC (Fault Tolerant Control) system [4], these type of systems are used for the ship mounted antennas. These system are robust and used for the navigation. FTC system are combination of fault diagnosis and accommodation units. This system detects the fault and reconfigure the control system, in order to maintain the antenna direction towards the satellite.

Mobile satellite communication [5] is developed to provide clear reception to the mobile user. Earlier these type of systems were operating on C and L bands over Lower Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellites. But because of orbital movements of the satellite and the movement of the user it become difficult to always keep track on the satellite.

Different types of mobile satellite antennas [6] are available today. These antennas can be classified according to their applications. They operate on L-band and provide gain up to 15dB. Patch antennas are used for land mobile satellite communication[7]. These antennas are tested on L-band frequencies and are of small size i.e. 15cm in Diameter. With some improvements these antennas can be used for the proposed system. As per the measurements shown in the paper these antennas are useful in coastal area and in the rainy season as well. The antenna tracking and the stabilization loops were designed according to the traditional bandwidth and phase margin requirements. However, the performance will degraded if the tracking loop gain is reduced due to parameter variations. On the other hand, a PD-type fuzzy controller [8] was also applied for tracking loop design. It is seen that the system performance obtained by the fuzzy controller is better for both low and high antenna tracking loop gains and tracking loop gain parameter variations effect can be reduced.

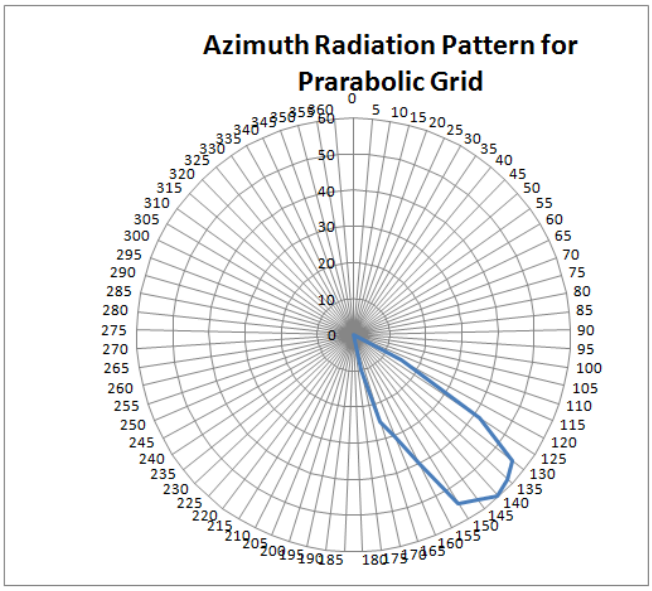
Block Diagram of Automatic Satellite Tracking System :

Below figure shows the block diagram of the automatic satellite tracking system.

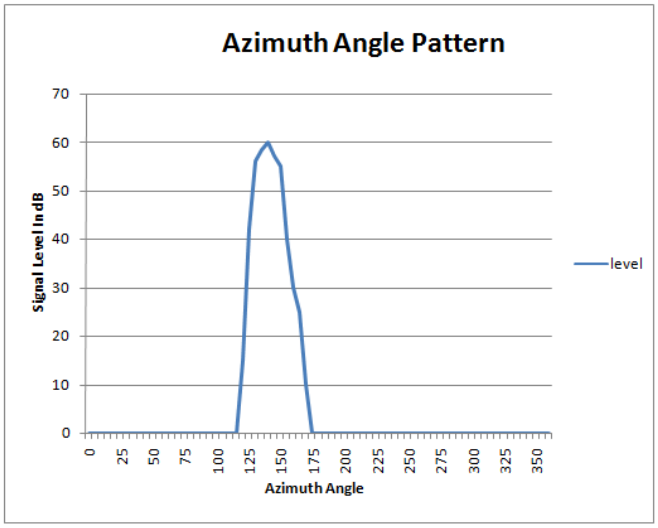


In order to make this system coast effective i.e. affordable by every DTH user, RF field strength meter used here is locally available low cost meter. This meter shows variations in RF field on analog scale. ADC is used here to convert analog signal in digital value. Output of ADC is read by the Micro-controller WHICH HAS A CODE WRITTEN IN IT'S FLASH. Micro-controller reads ADC compares it with the threshold value set and accordingly drives the motors connected to the antenna. Motors used are the geared DC motors moves the antenna in azimuth elevation plane accordingly. Plastic gear box is used to avoid the corrosion problem caused by humidity and rain. The system is tested and radiation pattern of antenna is shown below.

Result:



Radiation Pattern of azimuth angle for 40 cm size parabolic dish antenna



Above figure shows variation in signal strength with respect to the azimuth angle variation.

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