LOW COST PORTABLE SATELLITE TRACKING SYSTEM FOR DTH ANTENNA

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Abstract Direct To Home (DTH) from satellite television has become an integral part of today’s life. Because of the quality and number of services provided by the DTH television it became very popular. This caused rise to the number of service providers in India. Though today we find Dish antenna over every house, it has become now critical to know whether it is properly installed or not. Number of satellite service providers available today in India. Every individual satellite service provider is using different satellite. Each satellite has different look angle from the same geographical location. For a good quality reception the dish antenna should have desired diameter and it should be properly aligned. Here in proposed system human errors are eliminated by using motors aligned to the antenna which automatically tracks the desired satellite. The proposed system tries to acquire optimum signal strength for good quality reception irrespective of the geographical position and the satellite to be tracked.

INTRODUCTION

In India, Zee Networks 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 the 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 installs 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 different 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 the motors and some electronic 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 systems are available with large size of motors with very complex electronic control circuitry. These types of systems are not feasible to carry in the vehicle because of the size and weight of the system. Some of the systems are lightweight and can be installed over the vehicle but the cost 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 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 closed loop or open loop. So to eliminate above limitations of the present satellite tracking system there is the 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 form the particular location? Whether the location is in line of sight to the dish?
2. Improper dish Selection:
Size of dish antenna varies with the satellites 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 install, should not lie in shadow of a building or a tree. That will affect the signal quality.
4. Rain Attenuation:
DTH systems are operating on Ku band, the strength of satellite signal may be reduced under severe 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 in 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 systems. As these antennas are light in weight and small 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 used for mobile satellite television in future by making some improvement in the performance of the antenna control unit. These antennas are used in ship borne 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 types of systems are used for the ship mounted antennas. These systems are robust and used for the navigation. FTC systems 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 types of systems were operating on C and L bands over Lower Earth orbit (LEO) and Medium Earth Orbit (MEO) satellites. But because of the orbital moments of the satellite and the movement of the user it becomes 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 15 dB. 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. 15 cm 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 the 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 cost 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 microcontroller which has a code written in its flash. Microcontroller 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 and 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.
REFERENCES