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Satellite Dish Positioning Control by Geared Motor Using RF Module

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ABSTRACT: This paper is designed to develop a dish positioning system which can be operated by using RF Module. The main application of using a dish is to receive signal from satellites and other broadcasting sources. In order to position the dish to the exact angle to receive the maximum signal of a particular frequency, it needs to be adjusted manually. In order to overcome the difficulty of adjusting manually, this proposed system helps in adjusting the position of dish. An electronic dish position control system is made up of two motor that enable the dish to rotate both in horizontal and vertical direction remotely controlled. In order to reduce the speed, geared motor are used that are fed from the output of the motor driver IC, and position of the dish is adjusted.

KEYWORDS: RF Module, Geared Motor, Satellite Dish

I. INTRODUCTION

There are many commercial communications satellites in the geosynchronous orbit. Geostationary satellites are located in orbit directly above the equator and stay in the same place in the sky since they go around the earth at the same angular speed as that of the earth as it rotates. Satellite locations may thus be defined by longitude only. Geo Orbit position is the longitude position around the geostationary orbit. The satellites are all approximately fixed in the sky above the equator. Negative orbit position numbers are degrees West from Greenwich meridian. Positive numbers are degrees East. The use of East and West longitudes is popular for public use since the numbers are smaller. Use of degrees East only (0 to +360deg, going East from Greenwich) however is my preference since the satellites go around this way and it makes sense for the numbers to keep increasing if the satellite moves forwards. Trying to do orbit calculations is bad enough without having numbers that keep switching forwards and backwards. Many satellite operators also use the 0 to +360 deg method, but may additionally provide the “deg West” notation for some output publications. Imaginary lines, also called meridians, running vertically around the globe. Unlike latitude lines are not parallel. Meridians meet at the poles and are widest apart at the equator. Zero degrees longitude (0°) is called prime meridian. The degrees of longitude run 180° East and 180° West from the prime meridian .In this paper, RF module used to drive the DC motor of the satellite dish in terms of direction (East and West). . Remote control is used to command the signals to drive the DC motor of the satellite positioning dish. The main benefit of these project is to control the position feedback.. Satellite dish requires the accuracy. So it is suitable for controlling actual position of the systems. The system can locate the satellite receiver dish at five different positions

The most common issue anyone will come across when aligning the dish is aiming at the correct satellite for the broadcasts they require. Satellite receivers do have certain details on them regarding the satellites, but they cannot determine whether you are aligned to the correct satellite. They rely on the user to align the dish in the correct direction. There are certain details we will require in order to successfully align the satellite dish accurately to the correct satellite for our requirements.

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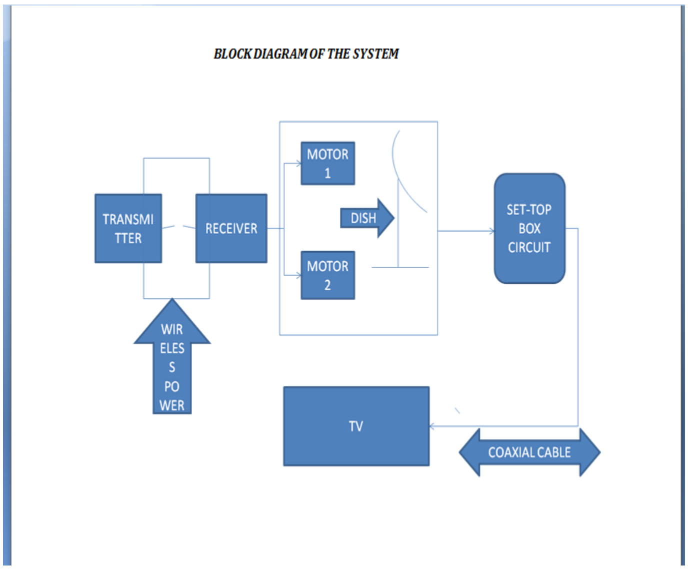

FIG1. BLOCK DIAGRAM OF COMPLETE SYSTEM

The full functional block diagram of a device is shown in fig. The device consist of blocks namely IR transmitter, IR receiver, driver circuit.

RF module receives the RF pulses sent form remote and converts it to corresponding electric pulses. These electric pulses are given to decoder. These data are used to take further control decisions The control output signals are given to driver circuit, which drives the actual device.

II. HARDWARE COMPONENT OF THE SYSTEM

A. RF Control Device –

The RF remote controller is composed of infrared remote control transmitter and infrared remote control receiver. Structure of remote transmitter circuit was made up of specific integrated circuit IC1 as the core element; matrix circuits for transmitter keyboard were composed of matrix switches, which could constituted input circuit of keyboard commands with pulse generator in the IC1 and signal encoder in the keyboard. Remote receiver was composed by specific integrated circuit IC2 installed with photodiode. When infrared light from remote control was received by photosensitive tube of receiver, the light signal will be transformed as the electrical signal by photosensitive tube

B. Description of Signals Of The RF Transmitter And Receiver

RF module receives the RF pulses sent form remote and converts it to corresponding electric pulses. These electric pulses are given to receiver circuit that decodes it to corresponding data byte using zero crossing detector and on chip timer and interrupt. These data bytes are used to take further control decisions. The control output signals are given to driver circuit, which drives the DC motor of the satellite dish. A Sony remote control transmitter is used in this paper. The Sony remote control is based on the Pulse-Width signal coding scheme. The code exists of 12 bits sent on a 40 kHz carrier wave. The code starts with a header of 2.4milli second (ms) or 4 times T, where T is 600 micro second (µs). The header is followed by 7 command bits and 5 address bits as shown in Figure.4. The address and commands exists of logical ones and zeros. A logical one is formed by a space of 600 µs or 1 T and a pulse of 1200 µs or 2T. A logical zero is formed by a space of 600 µs and pulse of 600 µs. The space between 2 transmitted codes

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when a button is being pressed is 40 ms. The bits are transmitted least significant bits first. The total length of a bit-stream is always 45 ms.

C. DC Motor Based Servomechanisms

Nowadays, the most popular motor is a servo motor that is used to control and drive for heavy load application. On the other hand, the servo motor cost is extensively high for this application. So, YURI 518R servomechanism is chosen for this system. The general view of the YURI 518R servomechanism is shown in Figure.5. It is supported to drive over 250 kg loads, when only driven by 36V DC motor

D. MAGNETIC REED SWITCH SENSOR

A reed sensor is a device that built using a reed switch with additional functionality like ability to withstand higher shock, easier mounting, additional intelligent circuitry, etc. When a magnetic force is generated parallel to the reed
switch, the reeds become flux carriers in the magnetic poles, which attack each other. If the magnetic force between the poles is strong enough to overcome the restoring force of the reeds, the reeds will be drawn together. The reeds switch is in a sealed glass capsule usually with a special insert gas that prevents the switch contacts from oxidizing (rusting). When a magnet is brought within a specific distance, the reed blades become opposite magnetic poles which attract. This closes the circuit and allows current to flow. When the magnet is taken away, the reed blades lose their induced magnetic and separate thereby opening the circuit. Because the switch is sealed it can be used in harsh environments. Reed switches respond to both magnetic poles(North and South).

III. WORKING MODULE

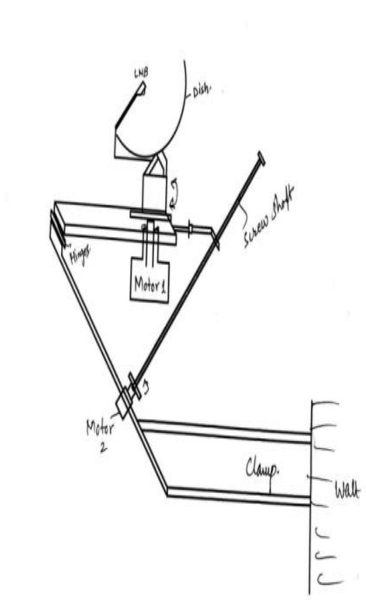

Fig2. Mounting Alignment

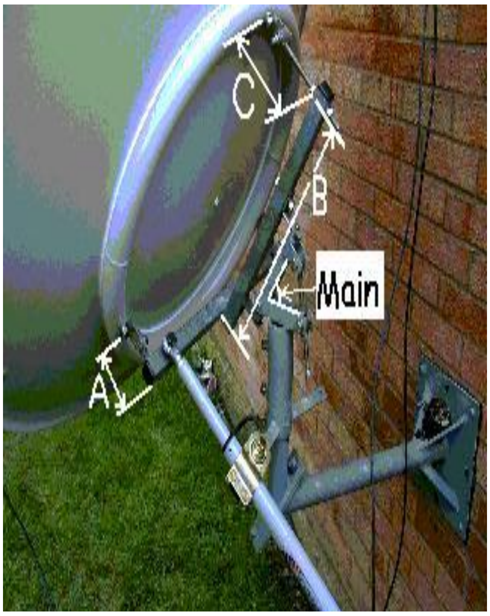

Fig3. Real Image

Fig4. Actual Mounting

Fig5. *RF transmitter*

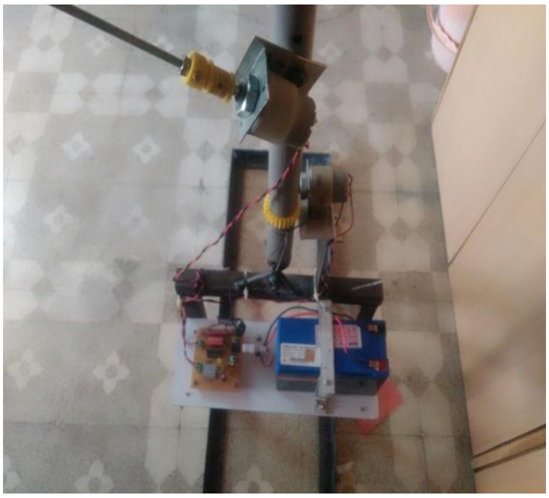

Fig6. Receiver circuit

IV. ABOUT SATELLITE DISH

Satellites used for television signals are generally in either naturally highly elliptical (with inclination of +/−63.4 degrees and orbital period of about twelve hours, also known as Molniya orbit) or geostationary orbit 37,000 km (23,000 mi) above the earth's equator

Satellite television, like other communications relayed by satellite, starts with a transmitting antenna located at an uplink facility.[7] Uplink satellite dishes are very large, as much as 9 to 12 meters (30 to 40 feet) in diameter.[7] The increased diameter results in more accurate aiming and increased signal strength at the satellite.[7] The uplink dish is pointed toward a specific satellite and the uplinked signals are transmitted within a specific frequency range, so as to be received by one of the transponders tuned to that frequency range aboard that satellite.[8] The transponder re-transmits the signals back to Earth at a different frequency (a process known as translation, used to avoid interference with the uplink signal), typically in the C-band (4–8 GHz), K_u-band (12–18 GHz), or both.[7] The leg of the signal path from the satellite to the receiving Earth station is called the downlink

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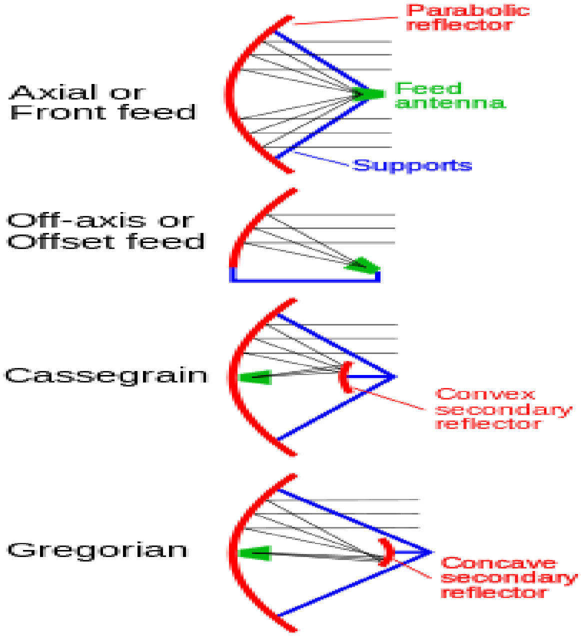
V. SCHEMATICS OF REFLECTION PRINCIPLES USED IN PARABOLIC ANTENNAS



The parabolic shape of a dish reflects the signal to the dish's focal point. Mounted on brackets at the dish's focal point is a device called a feedhorn. This feedhorn is essentially the front-end of a waveguide that gathers the signals at or near the focal point and 'conducts' them to a low-noise block downconverter or LNB. The LNB converts the signals from electromagnetic or radio waves to electrical signals and shifts the signals from the downlinked C-band and/or K_u-bandto the L-band range. Direct broadcast satellite dishes use an LNBF, which integrates the feedhorn with the LNB. (A new form of omnidirectional satellite antenna, which does not use a directed parabolic dish and can be used on a mobile platform such as a vehicle was announced by the University of Waterloo in 2004.[1]

The theoretical gain (directive gain) of a dish increases as the frequency increases. The actual gain depends on many factors including surface finish, accuracy of shape, feedhorn matching. A typical value for a consumer type 60 cm satellite dish at 11.75 GHz is 37.50 dB.

With lower frequencies, C-band for example, dish designers have a wider choice of materials. The large size of dish required for lower frequencies led to the dishes being constructed from metal mesh on a metal framework. At higher frequencies, mesh type designs are rarer though some designs have used a solid dish with perforations.

A common misconception is that the LNBF (low-noise block/feedhorn), the device at the front of the dish, receives the signal directly from the atmosphere. For instance, one BBC News downlink shows a "red signal" being received by the LNBF directly instead of being beamed to the dish, which because of its parabolic shape will collect the signal into a smaller area and deliver it to the LNBF.[2]

Modern dishes intended for home television use are generally 43 cm (18 in) to 80 cm (31 in) in diameter, and are fixed in one position, for Ku-band reception from one orbital position. Prior to the existence of direct broadcast satellite services, home users would generally have a motorised C-band dish of up to 3 m in diameter for reception of channels from different satellites. Overly small dishes can still cause problems, however, including rain fade and interference from adjacent satellites

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VI. APPLICATION

- Used in electronic industrial application
- Used in radar system
- Used in MEDIA
- Used in military
- Adding Video Camera for live streaming
- Used in surveillance

VII. CONCLUSION

This paper is intended to drive the satellite dish to select channel's position. This system uses remote control to start the motor moving in the desired direction. Using the remote control improves the dish positioning. The direction movement of the dish is indicated by two LED. If the motor moves in the forward direction, the green LED will indicate and for opposite direction the red LED will indicate. As soon as, the driven position is reached the motor stops running and two LEDs will off.. So, in this system, motor driver IC(L293D) which it is used to drive the motor with clockwise and counter clockwise direction. A satellite dish control system is critical to its tracking capability. Satellites are controlled by a ground station antenna on earth that sends commands and receives information from the satellites

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