Satellite Dish Positioning System

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Abstract

This paper is designed to develop a geosynchronous satellite dish positioning system which can be operated by using a remote control. Satellites are controlled by a ground station antenna (dish) an earth that sends commands and receive information from the satellite. Earlier to get the maximum signal of a particular frequency the dish is need to be positioned to the exact angle manually. Because of the difficulty of adjusting manually, this proposed system in adjusting the dish position by using IR remote control Remote control acts as a transmitter whose data is received by an IR receiver which is interfaced to a microcontroller of PIC 16F877A. The remote control sends coded data to the receiver whose output is then sent to the microcontroller. Basic pro language is also used to implement this system. The microcontroller sends the control signals to the motor through an interface known as relay driver.

Keywords: PIC 16F877A, Infrared (IR) Remote Control, DC Motor of the Satellite Dish

I. INTRODUCTION

This system is designed for geosynchronous satellite, geosynchronous satellite are located in orbit directly above the equator and travels at the rotational speed of the earth, and in the direction of the motion of earth that is eastward. The inclination of satellite with respect to earth must be zero degree. As there are so many places on earth, Satellite is required to precisely locate just one of the desired area to work more efficiently. To find the precise location parallels of the latitude and meridian of the longitude forming an invisible grid on the earth are used. The main idea behind our project is to design a control system which is capable of receiving information in the form of wireless data (via infrared light) and perform the necessary actions of rotating a dish in two axis (X-axis and Y-axis). The control system of satellite dish consist of the hardware like DC servo motor, PIC 16F877A microcontroller, Relay driver all are used to move the dish and the software written to control this movement.

II. LITERATURE REVIEW

This system is designed to position satellite dish which can be operated by using IR remote control. Here the control system used the hardware like DC servo motor, PIC 16F877A microcontroller, Relay driver all are used to move the dish and the software written to control this movement.

This is designed to developed a dish positioning system which can be operated by using a conventional TV remote. This system consist of two motors that enable the dish to move both in horizontal and vertical direction.

In this system, RF module receives the RF pulses send from remote and convert it to corresponding electric pulses. This pulses are given to decoder this data is used to take further control decisions. The control output signals are given to driver circuit, which drives the actual device.

The controller circuit is developed on a microcontroller-51 core microcontroller which searches the availability of the signal, whenever the signal found absent at the receiver. The controller drives the DC motor to rotate and this rotation goes on till the receiver found the signal. The controller provide necessary signal to the motor driver on which the antenna is mounted.

The paper describes a remote angular position control system of stepper motor using DTMF technology as alternative means of communication using RF with advantages of simplicity and availability.

The android application device acts as a transmitter whose data is received by Bluetooth device which is interfaced to a microcontroller of arduino family. The Bluetooth device sends control signals to the motors through an interface IC (Motor Driver IC). The Bluetooth device serially communicate with microcontroller.

III. ALIGNMENT OF DISH

A. *Lattitude and Longitude*

There are so many Places on earth how it is possible to precisely locate just one of them. To find precise location parallels of latitude and meridians of longitude from an invisible grid on the earth.

1) Latitude

Lines of latitude measure north-south position between the poles. The equator is defined as 0 degrees, the North Pole is 90 degrees north, and the South Pole is 90 degrees south. Lines of latitude are all parallel to each other, thus they are often referred to as parallels. Lines of latitude circled the Globe from East to West. These lines are at equidistant and 69 miles apart from each other, called 1 degree

1 degree=60 minutes

1 minutes= 60 seconds

Fig. 1: Latitude

2) Longitude

Lines of longitude, or meridians, run between the North and South Poles. They measure east-west position. The prime meridian is assigned the value of 0 degrees, and runs through Greenwich, England. Meridians to the west of the prime meridian are measured in degrees west and likewise those to the east of the prime meridian are measured to by their number of degrees east.

Unlike latitude the lines of longitude are at not equidistant from each other. Meridians intersect at North and South poles. Zero degree longitude is called prime meridian. It passes through Royal Greenwich observatory in Greenwich UK.

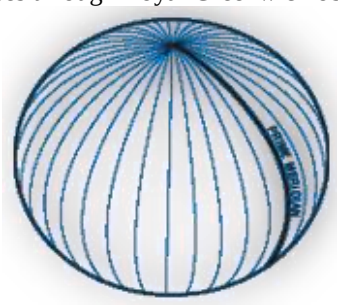

Fig. 2: Longitude

3) Look Angle

The co-ordinates to which an Earth station must point to communicate with satellite.

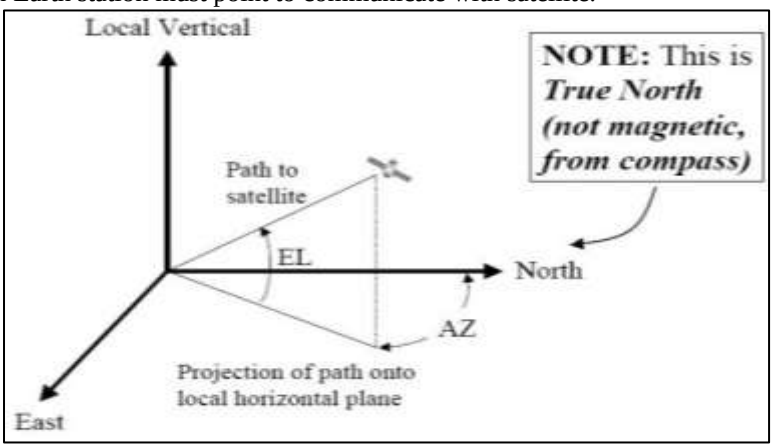

Fig. 3: Look Angle

4) Azimuth

This will be the heading required for the dish. The satellite that is broadcasting the signal will have a point of reference which the dish needs to be aligned to (for example, Astra 2A, B or D is a set at 28.2 degree East of True South).

B. Elevation

This is the angle of the dish elevation required that is above the reference heading for the satellite that we have aligned the heading towards. As the Earth curves, we need to find correct elevation for the area where the dish will be situated.

C. LNB Skew or Inclination

This is angle of the LNB on its axis. Much the same as the elevation, we are required to find the correct skew or inclination for the area where the dish will be situated.

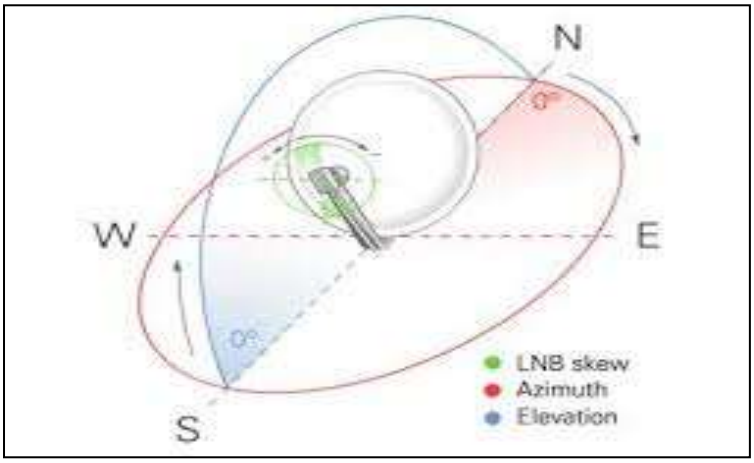

Fig. 4: Aligning the Dish

D. The Sub-Satellite Point

The Point, on the earth's surface of the intersection between a lines from the earth's centre to the satellite.

IV. BLOCK DIAGRAM OF THE SYSTEM

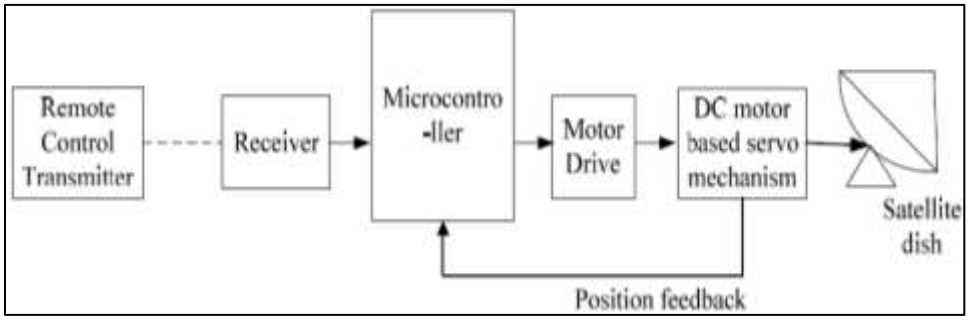

Fig. 5: Block Diagram of the System

A. Operation of the System

Firstly, the motor is reaching in something degree when the power supply on. This degree is called the last degree. If the setting switch is pressed to save degree and count of the motor of the satellite dish, motor will go to the lowest limit from current degree. After reaching to the lowest limit, the motor will stop. We get zero degree and zero count. Then the motor will go to the highest limit. After reaching the highest limit, the motor will stop. And then, the maximum degree is saved in the microcontroller. So the maximum degree and maximum count are got. Microcontroller calculated resolution and saved the degrees and pulses in EEPROM. When command degree from remote control fed to the PIC microcontroller, the motor is driven. The motor is driving with the counts. These counts are being sensed by reed sensor. Reed sensor feedback counts of driving motor to the microcontroller. Microcontroller makes increasing the counts if the command degree is greater than the last degree. While increasing the counts, the motor will be stopped by microcontroller when the command degree is equal to the last degree. Similarity, microcontroller makes decreasing the counts if the command degree is less than the last degree. While decreasing the counts, the motor will be stopped by microcontroller when the command degree is equal to the last degree.

B. Hardware Component of the System

1) Infrared Remote Control Device

The infrared remote controller was 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.

2) PIC Microcontroller

There are many different varieties of PICs. Some are OTP (One Time Programmable) type devices and some are Flash type devices. OTP devices are not well suited for electronics hobbyists because their software code cannot be changed when have been programmed. Flash type devices are repeatedly reprogrammed in-circuit.

There are generally three types of Flash type device microcontroller. They are PIC 16F84A, 18 pin microcontroller, PIC 16F628A, 18 pin microcontroller and PIC 16F877A, 40 pin microcontroller. PIC 16F877A microcontroller has built-in ADC (analog to digital converter), USART (universal synchronous and asynchronous receiver transmitter), PWM (pulse width modulation), more I/O ports and more program memory space. Because of its capability, it has been chosen in this system.

3) DC Motor Based Servomechanism

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 .It is supported to drive over 250 kg loads, when only driven by 36V DC motor. The mechanism consists of upper and lower limit switch. This limit switches are protected not to damage the mechanism for extremely drive and internal magnetic on the main axis and the feedback reed switch.

4) Reed Sensor Switch

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 this system used remote control for input device and LCD module for output device for user interfacing. Moreover other two different LEDs are used to indicate for motor direction movement. The DC motor is driven by two electromagnetic relays with the amplification of transistors. The position feedback is acquired by the usage of reed switch interface with the help of the Opto-coupler.

V. FLOW CHART

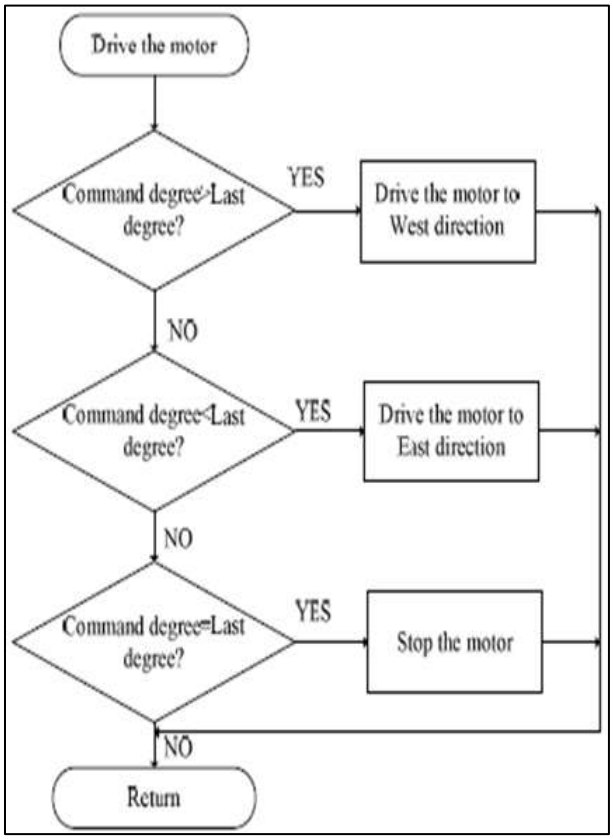

Fig. 6: Flow Chart for the Motor Operation

Microcontroller is used to drive the motor to the clockwise direction when the command degree is greater than the last degree and counterclockwise direction when the command degree is less than the last degrees in Figure.7. And it is used to drive the motor with the desired degree by calculating the command degree from remote and feedback degree from the reed sensor.

VI. ADVANTAGES

- The dish position, i.e. tuning, is very important for getting the standard–broadcast signals from the satellite. The dish must be pointed at a correct angle to get the strongest signal possible. If the dish position is adjusted manually, one cannot direct the dish towards the best possible position. This proposed system is invented to adjust the dish position through a simple IR remote control.
- Using a remote control improves the advanced technology.
- Using Microcontroller develops the motor to maintain the desired position

VII. DISADVANTAGES

- To direct the antenna having a large size such as 32 m Deep Space Antenna we require a motor which can drive such heavy load antenna for that large system we have to design. Such large mechanical system require high power this can be the disadvantage of this system.
- As some mechanical part is present in system which may cause the friction, can also be the disadvantage.

VIII. APPLICATIONS

A. Weather Forecasting

Certain satellites are specifically designed to monitor the climatic conditions of earth. They continuously monitor the assigned areas of earth and predict the weather conditions of that region. This is done by taking images of earth from the satellite. These images are transferred using assigned radio frequency to the earth station. These satellites are exceptionally useful in predicting disasters like hurricanes, and or the changes in the Earth's vegetation, sea state, ocean color, and ice fields.

B. Radio and TV Broadcast

These committed satellites are in charge of making 100s of stations over the globe accessible for everybody. They are additionally in charge of broadcasting live matches, news, overall radio administrations. These satellites require a 30-40 cm estimated dish to make these stations accessible all inclusive.

C. Military Satellites

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IX. CONCLUSION

Microcontroller is most appropriate for auto situating system. In this framework, a satellite situating framework has been created. A satellite dish control framework is basic to its following ability. This framework is utilized remote control to begin the engine moving the coveted way. Microcontroller are broadly utilized everywhere throughout the world and it depends on the most recent technologies. Using the remote control enhances the propelled innovation. Also, utilizing the Microcontroller builds up the engine to keep up the coveted position. Despite the fact that this is the principal moving toward venture to control framework, robotization framework and mechanical autonomy frameworks, these can extraordinarily serves to the modern control.

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