AUTOMATIC SATELLITE SIGNAL TRACKING SYSTEM

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To My Beloved Father and Mother

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ABSTRACT

This project will construct an Automatic Satellite Signal Tracking System. The model of satellite tracking used a comparator circuit to control the system. A simulated tracking satellite system using UHF bands have successfully developed.

ABSTRAK

Projek yang akan dijalankan adalah untuk membina sebuah Sistem Pengecam Satelit Signal Automatik. Model ini akan dikawal oleh satu litar yang dikenali sebagai Litar Pembandingan. Satu simulasi telah berjaya dijalankan apabila diuji dengan jalur gelombang UHF pada sistem tersebut.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The use of satellite in communication systems is very much a fact of everyday life, as is evidenced by the many homes which are equipped with antennas or dishes used for reception of satellite television. Satellite form an essential part of telecommunication systems worldwide, carrying large amounts of data and telephone traffic of data in addition to television signals.[1]

A satellite communications system uses satellites to relay radio transmissions between earth terminals. The two types of communications satellites are ACTIVE and PASSIVE. A passive satellite only reflects received radio signals back to earth. An active satellite acts as a REPEATER; it amplifies signals received and then retransmits them back to earth. This increases signal strength at the receiving terminal to a higher level than would be available from a passive satellite.[2]

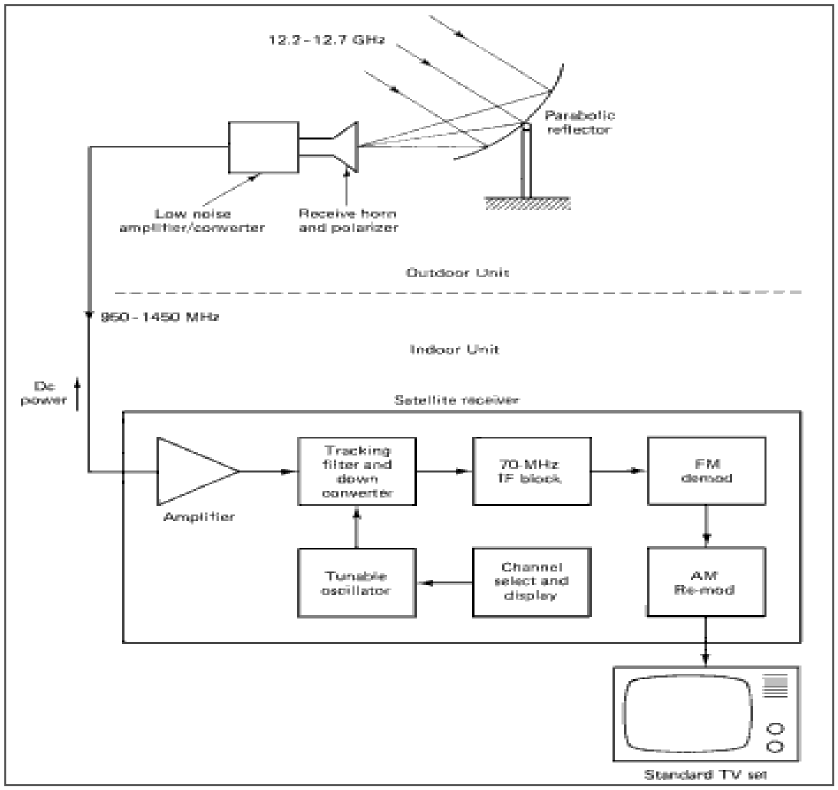


Figure 1.0 Block Diagram of Home Terminal Reception

Figure 1.0 shows the communication between outdoor unit and indoor unit. Outdoor unit consist the antenna types, horn receiver and low noise amplifier/converter. The signal on the antenna will be transmit to indoor unit consist satellite receiver and output device (television).

Satellite communications offer a number of features not readily available with other means of communications. The areas of the earth are very large to the satellite, because of that, the satellite can form the star point of a communications net linking together many users simultaneously, user who may be widely separated geographically. The same feature enables satellite to provide communications links to remote communities in sparsely populated area which are difficult to access by other means [1]. Thus, this project will gather all the data needed to predict the telecommunication system model.

1.2 PROJECT OBJECTIVE

The objective of my project is to develop a model of Automatic Satellite Signal Tracking System.

1.3 SCOPE OF WORK

After identified the scope of work needed, there are several main areas that have to be done:

1. Literature Review

   These consist of existing research done about satellite system prediction and design model.

2. Suitable data for design

   The system design will consider the suitable parameter in order to determine the model

3. Prototype model

   Since all the parameters and component of circuits were gathered, next is to predict the model.

4. Performance testing

   After constructed the circuit for the system, the circuit are need to test the effectiveness and maintain the results

5. Model of system

   Finally, the model of Satellite Tracking System will be developed.

1.4 PROJECT METHODOLOGY

This project started by studying the basic fundamental of satellite communications. All of this information was obtained from journal, paper, book and sites.

There are many types of tracking system designed in the market today, but several of them are operated in manual way. By improving the existed design, the system will able to operate automatically. The signal tracked on the antenna/dishes usually comes from many different angles before it can store into receiver panel. The problem is, the rotation of antenna/dishes only can rotate in 2 ways either horizontal or vertically. After some considerations, the system will operate the antenna/dishes on horizontal ways which give more area of searching to antenna/dishes.

Besides attenuation effects, the strength of signal coming into antenna/dish also need to be considered. The signal captured on the antenna must be strong enough to trigger the comparator circuit. Means, the antenna wouldn't stop rotating if signals are not strong /sufficient.

It's very important for antenna to rotate smooth and slow enough to capture the signal. These motors must capable to rotate 360 degree forward and backward since several wires will attach to motor's body. If not, wires might be twisted around and spoils the VHF and UHF plates.

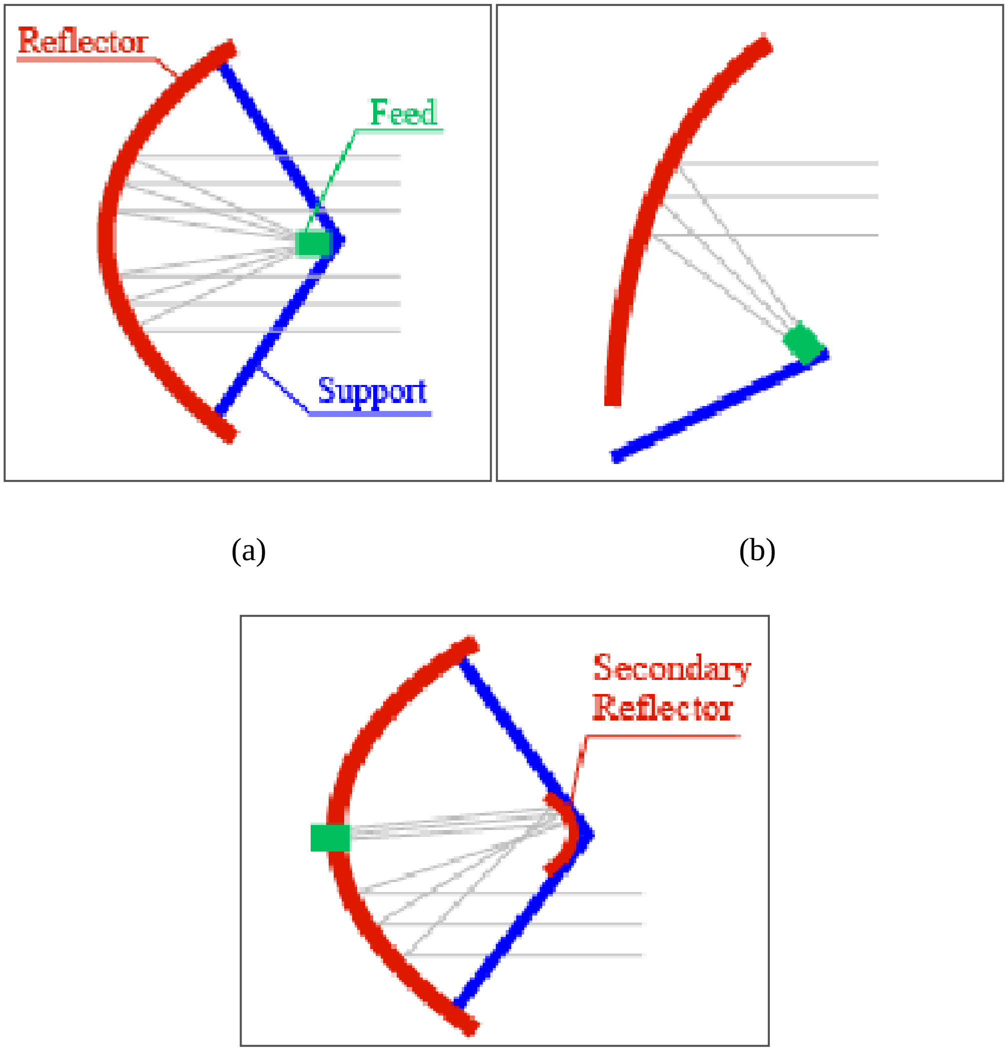
The comparator circuit is a very important part where it can control the motor's rotation to stop or keep rotate. The details about choosing the IC will be discuss in the results later.

CHAPTER 2

LITERATURE REVIEW

2.1 SATELLITE DISHES

A satellite dish is a type of parabolic antenna that receives or transmits electromagnetic signals to and from another location typically a satellite. A satellite dish is a type of microwave antenna. Satellite dishes come in varying sizes and designs, and are commonly used to receive satellite television. Many of the offset type of satellite dishes are sections of a larger parabolic dish. **Figures 2.1(a), (b)** and **(c)** show the types of satellite dishes such parabolic, Off-center and Cass.



(a) (b)

(c)

Figure 2.1 Types of dishes (a) Parabolic, (b) Off-center, (c) Cass

The parabolic dish (a) shape reflects the signals directly to the feed placed at the focus point of the dish. Off-center dish (b) operates same as parabolic, but the support of the feed is placed quite lower than the center where the Off-center's focus point is placed. The Cass dish (c) has 2 reflectors where signal will reflect twice as to the feed. The Cass's feed is placed at first the reflector.[1]

2.1.1 Parabolic

There are a number of dish antenna types. The first and simplest is the Prime Feed Focus dish, which is a parabolic dish with the LNC mounted centrally at the focus. Because the LNC is mounted centrally, it means that a lot of the incoming signals are blocked by the LNC. Its efficiency of 50% is low compared with the other types. The Prime Feed Focus dishes are mainly used for antennae with diameters over 1.4 meters. The parabolic antenna is less sensitive to small directional deviations and there is a better chance of receiving signals outside the normal footprint. On the other hand, rain and snow can easily collect in the dish and could interfere with the signal.[3]

2.1.2 Off Dish

The Offset Dish Antenna has its LNC not mounted centrally, but to the side of the dish. Because the LNC no longer obstructs the signal path, the dish has a better performance than the Prime Feed Focus dish. This allows the dish diameter to be smaller. Another advantage of this type of dish is that it can be positioned almost vertically, whereas the Prime Feed Focus dish needs to be positioned more obliquely. The problem that it could collect rain and snow and give disturbance to the signals is therefore less likely to happen.[3]

2.1.3 Cass

The Cass (Dual Offset Dish) Antenna is an improvement on the Offset Dish antenna and has an even better performance. Its efficiency is about 80%. The main feature of this antenna is that it has two dishes: a larger receiving dish and a smaller dish facing the opposite direction which collects the signals from the larger dish and directs it to the LNC.[3]

2.1.4 Principle of operation

The parabolic or any 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' those to a low-noise block downconverter or LNB (**Figure 2.03**). The LNB converts the signals from electromagnetic or radio waves to electrical signals and shifts the signals from the downlinked C-band and/or Ku-band to the L-band range. Direct broadcast satellite dishes use an LNBF, which integrates the feedhorn with the LNB. (A new form of unidirectional satellite antenna, which does not use a directed parabolic dish and can be used on a mobile platform such as a vehicle).[4]

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. At 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, the device at the front of the dish, receives the signal directly from the atmosphere. For instance, one news countdown shows a "red data stream" 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.[4]

(1) (2)

Figure 2.2 (1) C-band dishes, (2) Ku-band dishes

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 motorized C-band satellite dish of up to 3 meters 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.[5]