

SPECIAL PHOTOS OF THE ARCHITECTURAL BEAUTY IN ASMARA

KNOWLEDGE MULTIPLIES IN SHARING

MENTOR #1

OCTOBER 2016



- *HOVERCRAFT
- *DATA MINING
- *DIGITAL SATELLITE
POSITIONING
- *SUSPENSION BRIDGE IN
MASSAWA



GREETINGS

As we graduate from high school we start facing some very difficult yet very important choices in our lives. In this stage of our lives most of us turn 18 and we are socially and legally considered adults. we start to get burdened with a lot of responsibilities that are hard for most of us but as it is the right way of passage we all go through this whether we like it or not. The first and main question we have to answer is "What are you going to do with your life?" and it's a make or break it decision. Unfortunately there are a lot of questions being asked of us but very little answers are provided. Very few of us make the informed decisions that could help us a great deal latter. As higher education is the next vital step, Most of us continue our studies branching out in to different fields of profession.

In this stage as well, another problem occurs, there are very few people who know what awaits at the other end of the tunnel and spend their time acquiring the skills that will be most useful, the rest just try to walk blindly to collect most of the pieces of the whole picture they need to see till the very end of their studies to actually see what it looks like. Some not understanding what it is they are looking at. Coming through this ordeal and entering the professional world the confusion and dissatisfaction just gets worse and worse. We understand all of these because we walked this same path but no one should suffer unnecessarily like this. This problem is endemic throughout the world. The aim of this e-magazine is to lessen this suffering and try to help people going through this to make sense of it all. This e-magazine is going to help those new high school graduates to understand what to expect as they enter different fields of studies seeing the senior projects done by graduating students from different fields and decide which abilities interest them most and pursue it.

As for those that are entering the professional world they will be able to get answers and guidance by their senior professionals in their respective fields by being able to show what they could do and get feedbacks and corrections for what they show and gain better help to refine their works from people all over the world. This opportunity will also give interested senior professional a chance to mentor their juniors by giving their constructive guidance and transition the students from being learners to doers and shorten the journey by sharing their experience and eliminate unnecessary mistakes or missteps that could deter the young pros. This e-magazine has 3 main aims, one is to promote professionalism, to help people excel in their fields of studies and advocate for the much needed mastery in professions to be effective. Second is to encourage and lead the way to intrafield exchange of knowledge. Since no field actually functions on its own without the participation of others in this web of interdependency that we live in, People of different fields should exchange information and try to fill different gaps to get a productive outcome. Third is to give way to the last step of studying or knowing , that is applying it in real life and produce or manufacture in to the physical form of products that can be used.

Therefore whatever it is you want to share with everyone else please keep these points in mind when you write it. Your content should be concise, to the point and qualitative. It should not exceed 4 pages and it is preferable if it has pictorial descriptions or explaining photos. Please include the general introduction to the topic you are talking about, describe clearly what you did in your project and what it focuses on, also the challenges you faced during the course of your project, and real life practices of your project. Don't forget to mention tools used, sources and references, and your contact address. The platform is also open to those who have opinions on the projects shared. Send your contents via email to eriscigroup@gmail.com

Thank you.



DESIGN OF HOVERCRAFT WITH RETRACTABLE WHEELS

A hovercraft is a relatively new means of transportation. Its concept was born when engineers came up with an experimental design to reduce drag on ship. The idea was to use a cushion of air between boats and the water they plowed through in order to reduce friction. This idea eventually led to what is known today as the hovercraft, basically a vehicle that uses one or more fans to float on a cushion of air. these fans serve a dual purpose, to push air between the craft and forcing it off ground and to create forward thrust by pushing air out the back of the craft.

While hovercraft do exist, their poor maneuverability and lack of an effective braking system have prevented them from gaining widespread acceptance. High cost and lack of knowledge and understanding by the general public also kept them out of the spotlight. To correct these limitation this project introduces a retractable wheel mechanism to the existing hovercraft.

The design objective of the project is to design a hovercraft with retractable wheels that can travel on land as normal vehicle under the following conditions

- * Hover over water using it's lift as well as thrust fans
- * While the wheels are in retracted position
- * Retract it's wheels as it goes from habitat to land
- * Power transmission to the fans will halt as it travel on land.
- * Power transmission will only be to the fans.

Hovercrafts work on the two main principles of lift and propulsion. Lift is an essential factor because it is that which allows the craft to ride on a cushion of our several centimeters off the ground. If too much airflow is directed under the



craft, it will then hover too high above the ground resulting it to tip. The source of the airflow which propels the craft of the ground is a fan. The fan can be used for lift and thrust. Another vital component is the motor which is located in the rear of the vehicle and is the heaviest of the components. Which makes hovercraft so efficient and different from other vehicles of its category is that very little force is required for it to move. Propulsion is thrust which makes the craft move. Hovercraft have no contact with the ground therefore any resistance the ground may produce under other circumstances is now non existent for the craft.

The skirt is another vital component. The common skirt is known as a bag skirt. It is comprised of a bag that covers the bottom of the point and has holes in it to allow air to escape and push the craft off the ground. Each part of the skirt inflates independently which makes repairs much easier and improves stability.





The aim of this project is to modify the existing hovercraft by introducing certain mechanical and hydraulic component and a more modified transmission system like the retractable wheels and travel motor. These integration of enhanced components to the hovercraft will eliminate the disadvantages like low performance on the land, noise, not good braking system and its ability to skid at different turning angles.



Hovercraft wheels in water bodies.



Hovercraft wheels in land.

Before anything there is a principle needed to notice that the shock absorber axis should be vertical with the vehicle which purpose is that the interference is avoided between shock absorber and lower control arm when lifting wheel. Large vehicles retraction system is nearly always powered by hydraulics. The hydraulic pump is driven off by the engine accessory drive.

When the handel is put in the turn down position, a switch is made that turns on the electric motor in the power back. The motor turns in the direction to rotate the hydraulic gear pump, so that it pumps a fluid to the top side of the actuating cylinders. Pump pressure moves the spring-loaded shuttle valve to the left to allow fluid to reach all four actuators. While hydraulic fluid is pumped to extend the wheel, fluid from the upside of the actuators returns to the reservoir through gear-up check valve. When the wheels reach the down and locked position, pressure builds in the wheels down line from the pump and the low pressure control valve unseats to return the fluids to the reservoir. Electric limit switches turn off the pump when all four wheels are down and locked.



Overview of the wheels

Axial piston pumps (reciprocating pump) convert rotary motion in to an axial reciprocating motion. This is accomplished by SWASH PLATE. As the piston barrel assembly rotates around the shaft with the piston slippers in contact with and sliding along the swash plate surface. During 1/2 of the cycle of rotation, the piston moves out of the cylinder barrel and generates an increasing volume.

Working principle of travel motor - The travel motor are axial piston swash plate design. Incorporated in the travel motor is the travel brake, which is spring engaged hydraulically release multiple disc brake. The travel motor brake valve directs system pressure through the poppet on the right side of the travel motor. Pressure goes through the poppet and the passage to the bottom. Pressure enters the parking brake and pushes the brake piston to the right against the spring force to release the brake.



Reciprocating pump (piston pump)

TWO-SPEED OPERATION; In low speed , system pressure from the main control valve is directed through the travel motor brake valve to the travel motor. The system pressure is then directed through the speed change valve to the low speed servo positions. The low speed servo pistons shift the travel motor swash plate to the maximum angle position for low speed travel. A pilot pressure signal from the two speed solenoid on the pilot manifold shifts the speed change valve to the HIGH SPEED position. System pressure is directed through the travel motor except the pressure is directed through the opposite envelope of the speed change valve to the high speed servo pistons. System pressure shifts the swash plate to the minimum angle for minimum displacement and high speed operation.

The ECU controls the two speed solenoid operation. when high speed is chosen, the ECU turns the two speed solenoid on. When the system pressure increases to approximately the maximum pressure needed by the travel motor on the wheels the ECU turns the two speed solenoid off and the travel motor shifts to the low speed travel automatically. When travel system pressure decreases, the ECU turns the two speed solenoid on to again shifts to high speed.

CONTROL SYSTEM- When the operator is moving the hover. The pump supplies the travel valves. This ensures the hover will continue to travel straight.

Negative flow control valves on the ends of the main control valve maintain back pressure. The negative flow control valves send signal oil to the pump controls. The signal pressure is reduced when a spool shifts and the required back pressure is not present.



Overview of hovercraft with retracted wheels

PILOT CONTROL SYSTEM- The pilot pump is a fixed displacement gear design pump located inside the main pump housing and it is driven off the drive gear for the main pump. Pilot system goes from the pilot filter to the pilot manifold. The pilot manifold serves as a distribution point for the pilot system flow. Flow enters the pilot manifold and goes through a check valve to the pilot accumulator, which helps hold in the accumulator pressure after the engine is stopped. Mounted on the top manifold are three solenoid valves. Two of these solenoids are ON/OFF directional solenoids.

Pilot pressure is also directed to the main control through the hose. The pilot system goes through two orifices in to the pilot logic network inside the narrow upper portion of the main control valve. The two orifices maintain pilot pressure in the pilot system by allowing only a small portion of the pilot flow to circulate through the open center passages in the pilot logic network. When one or more of the hydraulic control valves is activated, the open center passage in the pilot logic network is blocked and the pressure then increases downstream of the orifice.



The pilot pressure increase used to activate the travel pressure switch, and the straight travel control valve.

FUTURE IMPROVEMENTS-

- * Redesigning of the chasis and body frame
- * Designing of steering system on land
- * Designing of accessory parts
- * Implement new ideas on power transmission

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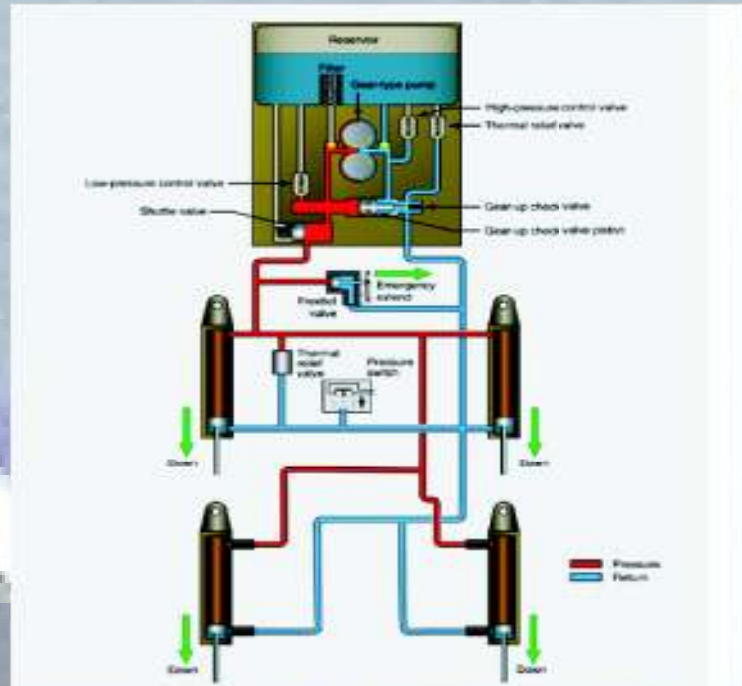
Tools and softwares used

- * AutoCAD 2012 & 2014
- * Solid works and other design software

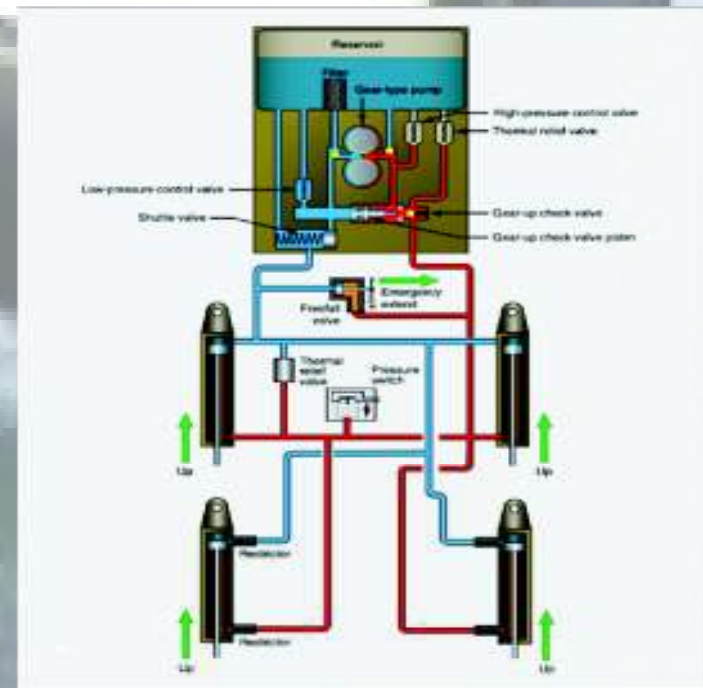
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ACADEMIC YEAR - 2014/2015 (EIT)



Release of wheel mechanism



Retracted wheel mechanism





DATA MINING

Data mining is the computational process of discovering interesting patterns and knowledge from large amounts of data, involving methods at the intersection of artificial intelligence, machine learning, statistics and database systems. Many industries successfully use data mining, it helps the retail industry model customer response. It helps banks predict customer profitability. It serves similar use cases in telecom, manufacturing, the automotive industries, higher education, life sciences and many more.

Data mining holds great potential for the health-care industries. But due to the complexity of healthcare organization and a slower rate of technology adoption, our country has not yet implemented effective data mining strategies. That is the reason our group decided to design and develop a medical data mining project. the main goal of this project was to create a user oriented, systematic approach of analysing data using data mining techniques. Using those analysis techniques, the project can :

- * Predict trends of a particular disease
- * Find any natural relations between patient demographics and disease. It identifies which disease are most likely to occur within the parameters of a specific factor of age, residence location and gender of a particular patient.
- * Find any association between diseases. That is, it identifies the most likely disease to occur associated with a particular disease. Such examples are opportunistic infections.
- * predict the birth rates and death rates
- * Analyse data for a specific information based upon the analyst's preferences.

The project was a collection of four parts; the database, the data warehouse, the data mining processes and the reports.



The database is where the raw data is entered and taken from to be processed. This is where the information and general history of a patient is registered. We have organized our data in tables and we used SQL Server Management Studio software for the task.

A data warehouse is a subject-oriented, integrated, time-variant, and non-volatile collection of data in support of management's decision making process. It is used for systematic arrangement of data for mining. As the data in the database cannot be mined for information as it is, it has to be cleaned, integrated and be processed before it can be mined for patterns using mining algorithms. This is where the data warehouse comes in.

The data warehouse is developed from the data base and it is what holds summary of the database by date, type, address and others to prepare the data for mining. In our project, we used the star-schema of data warehouse with one fact table and multiple dimension tables. In our project we have used the SQL server integration services package for the preparation of data warehouse. This package contains a series of tasks for data cleaning, eliminating noisy data and finally populating the data from the database to the data warehouse on which mining algorithms can be applied.



***Microsoft Clustering Algorithm** : finds natural groupings inside your data when these groupings are not obvious. In other words, it finds the hidden variable that accurately classifies your data. The Microsoft clustering algorithm is used in this project to identify the natural groupings between patient demographics and disease, and disease occurrence probability with age,gender

A : The star-schema contains a large central table called fact table which contains the bulk of the data, with no redundancy, and a set of smaller attendant tables called dimension tables, one for each dimension.



We used it because it is the simplest and most efficient for the project.

While developing this project we had certain challenges. The first is that there is no infrastructure on which this system can run. It requires computerized way of handling information and networked environment. There haven't been any of these environments implemented yet, and it costs a lot of fund to be implemented. The other major challenge is data collection. All the hospitals in our country use manual way of handling patient information and history. Therefore the project, will need a lot of data to be entered into the database to base its analysis. Due to these reasons this project is a model for now but it surely serves an example of the many things that can be done to enhance the medical field using technology.

Some of the worlds great companies successfully implement data mining such as:

BBC - TV program schedulers would like to know the likely audience for a proposed program and the best time to show it. The data for audience prediction are fairly complex. Factors which determine the audience share gained by a particular program include not only the characteristics of the program itself and the time at which is shown, but also the nature of the competing programs in other channels. using Clementing, Integral Solutions Limited developed a system to predict television audience for the BBC. The prediction accuracy was reported to be the same as the achieved by the best performance of BBC's planners.

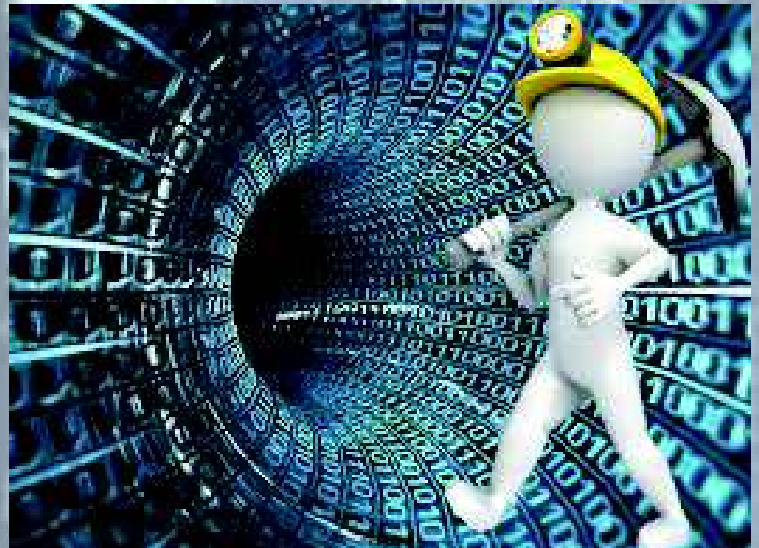
Capital one financial group - Financial companies are one of the biggest users of data-mining technology. One such user is capital one financial corp., one of the nation's largest credit-card issuers. It offers 3000 financial products including secured, joints, co-branded, and college studentcards. Using data mining techniques, the company tries to help market and sell the most appropriate financial product to 150 million

potential prospects residing in its over 2-terabyte Oracle-based data warehouse. Even after a customer has signed up, Capital one continues to use data mining for tracking the ongoing profitability and other characteristics of each of its customers. The use of Data mining and other strategies has helped capital one expand from \$1 billion to \$ 12.8 billion in managed loans over 8 years. An additional successful data-mining application at capital one is fraud detection.

Kroger Co.(USA)- The kroger is the largest grocery store chain in the United States. Forty percent of all U.S households have one of Kroger's loyalty cards. The kroger is trying to drive loyalty for life with their customers. In particular, their customers are rewarded with offers on what they buy instead of trying to be sold something else. In other words, each of them could receive coupons different from each other, not the same coupons. In order to match the best customers with the right coupons, the Kroger analyzes customers' behaviour using the data-mining techniques. For instance, one recent mailing was customized to 95% of the intended recipients. Such business strategy for looking at customers to win customers for life makes the Kroger beat their largest competitor, Wal-Mart, for the last 6 years largely.

Main Medical Center- a teaching hospital and the major community hospital for the Portland, Maine, area has been named in the U.S. News and World Report Best Hospitals list twice in orthopedics and heart care. In order to improve quality of patient care in measurable ways, Maine Medical Center has used scorecards as key performance indicators. Using SAS, the hospital creates balanced scorecards that measure everything from staff hand washing compliance to whether a congestive heart patient is actually offered a flu vaccination. One hundred percent of heart failure patients are getting quality care as benchmarked by national organizations, and a medication error reduction process has improved by 35%.

In November 2009, the Central Maine Medical Group(CMMG) announced the launch of prevention



and screening campaign called " Saving Lives Through Evidence - Based Medicine ". The new initiative is employed to redesign the ways that it works as a team of providers to make certain that each of our patients undergoes the necessary screening tests identified by the current medical literature using data - mining techniques. In particular, data-mining process identifies someone at risk for an undetected health problem.

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MICROCONTROLLER BASED SATELLITE DISH POSITIONING SYSTEM

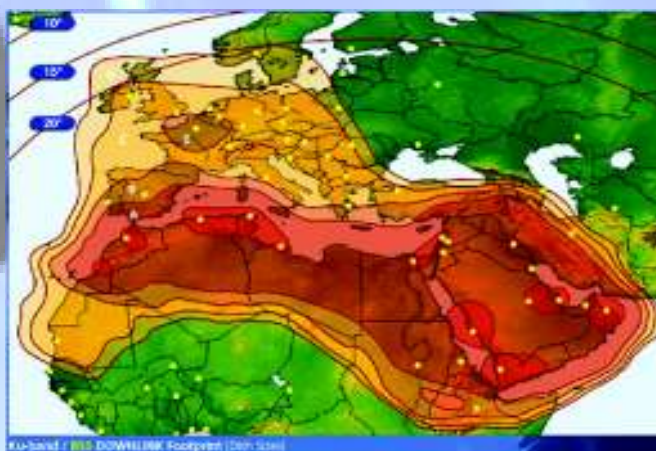
The main point of using satellite dish is to receive signal from satellites and broadcasting sources. In order to get the exact position of the dish it needs to be adjusted manually. Manual adjustment requires much effort and costs a lot of time. The exact position determination is not simple task that it follows try and error principle. In order to overcome this difficulty of adjusting manually this paper helps us in adjusting the position of the dish through a remote control. 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 send the control signals to the motor through an interface known as relay driver. The motor rotates the dish to the required position. In this paper with the help of microcontroller the exact position can be found in a short period of time. And using the remote control the rotation of the dish can be controlled from a distance which reduces the effort.

The electromagnetic signals scattered in our space are received by a satellite dish antenna and this satellite dishes are capable of receiving one satellite at a particular position at a time. In order to have the accesses to another satellite it is mandatory to change the position manually now and then because of the position difference of satellite. This project is all about changing the position of satellite dish from one satellite to another automatically. This will be done using motors to rotate the satellite dish antenna controlled by microcontroller.

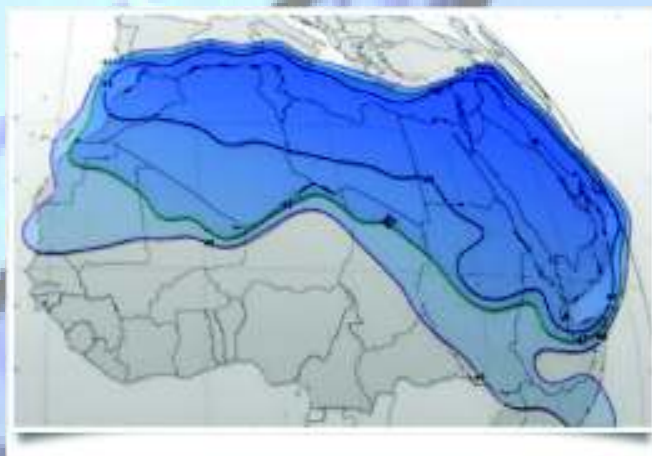
The microcontroller counts the time in which the motors rotates and reaches the exact position of each satellite from the reference point. In this way, the position of the satellite dish can be changed and controlled by the microcontroller.

In this project three modules are used in controlling the motion. The first module is the IR receiver, which receives digital signal from IR remote. . The second module is the commanding unit. In this module the IR receiver will command the microcontroller to initiate the rotation of the motor. The third module is the microcontroller. It will count the time to the commanded position of the satellite and will stop the movement when it reaches the destination.

FOOT PRINT OF ARAB SAT AND NILE SAT



ARAB SAT



NILE SAT



PROJECT SETUP

Importance of the project

Manual positioning provides only one choice of satellite. This project will give a suitable situation for anyone to access any number satellite of their choice.

In order to have the access to every satellite available to our site we have to introduce automatic positioning of satellite dish.

Hence this will solve the limitation of the choice of satellite as well as the need for expertise to install.

Objectives

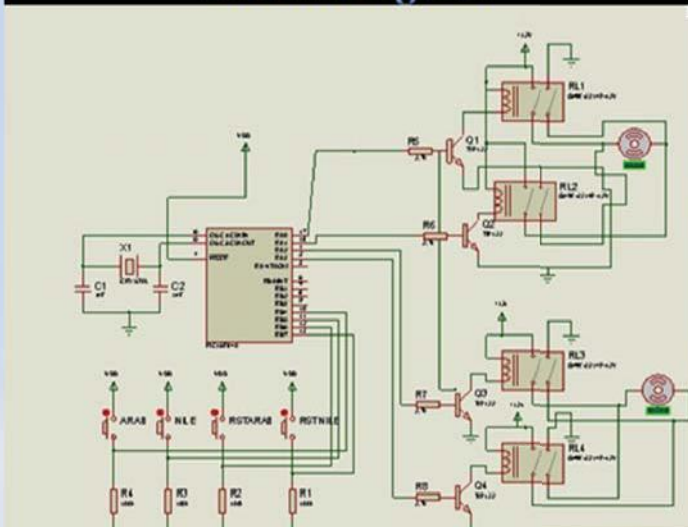
- * Avoid manual installation
- * Provide number of satellite
- * User friendly application

How it works

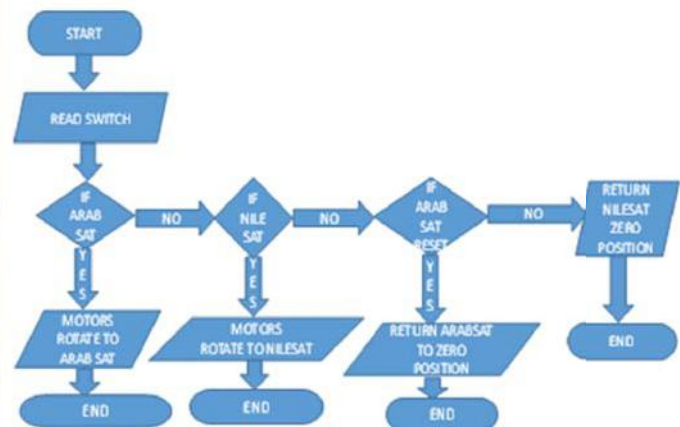
The provider selects programs and broadcasts them to subscribers as a set package. Basically, the provider's goal is to bring dozens or even hundreds of channels to the customer's television in a form that approximates the competition from Cable TV. Unlike earlier programming, the provider's broadcast is completely digital, which means it has high picture and stereo sound quality.

Early satellite television was broadcast in C-band radio in the 3.4-gigahertz (GHz) to 7-GHz frequency range. Digital broadcast satellite transmits programming in the Ku frequency range (10GHz to 14GHz). There are five major components involved in a direct to home (DTH) satellite system: the programming source, the broadcast center, the satellite, the satellite dish and the receiver.

Circuit diagram



Flow chart





The Broadcast Center

The broadcast center converts all of this programming into a high-quality, uncompressed digital stream. At this point, the stream contains a vast quantity of data- about 270 megabits per second(Mbps)for each channel. In order to transmit the signal from there, the broadcast center has to compress it. Otherwise, it would be too big for the satellite to handle. The provider use the MPEG-2 compressed video format. With MPEG-2 compression, the provider can reduce the 270-Mbps stream to about 3 to 10 Mbps(depending on the type of programming). This is the crucial step that has made DTH service a success. With digital compression, a typical satellite can transmit about 200 channels. Without digital compression, it can transmit about 30 channels.

Encryption and Transmission

After the video is compressed, the provider needs to encrypt it in order to keep people from accessing it for free. Encryption scrambles the digital data in such a way that it can only be decrypted (converted back into usable data) if the receiver has the correct decoding satellite receiver with decryption algorithm and security keys.

Once the signal is compressed and encrypted, the broadcast center beams it directly to one of its satellites. The satellite picks up the signal, amplifies it and beams it back to Earth, where viewers can pick it up.

The Dish

A satellite dish is just a special kind of antenna designed to focus on a specific broadcast source. The standard dish consists of a parabolic (bowl-shaped) surface and a central feed horn. To transmit a signal, a controller sends it through the horn, and the dish focuses the signal into a relatively narrow beam.

The dish on the receiving end can't transmit information; it can only receive it. The receiving dish works in the exact opposite way of the transmitter. When a beam hits the curved dish, the parabola shape reflects the radio signal inward onto a particular point, just like a concave mirror focuses light onto a particular point. The curved dish focuses incoming radio waves onto the feed horn.

In this case, the point is the dish's feed horn, which passes the signal onto the receiving equipment. In an ideal setup, there aren't any major obstacles between the satellite and the dish, so the dish receives a clear signal.

In some systems, the dish needs to pick up signals from two or more satellites at the same time. The satellites may be close enough together that a regular dish with a single horn can pick up signals from both. This compromises quality somewhat, because the dish isn't aimed directly at one or more of the satellites. A new dish design uses two or more horns to pick up different satellite signals.





As the beams from different satellites hit the curved dish, they reflect at different angles so that one beam hits one of the horns and another beam hits a different horn.

The central element in the feed horn is the low noise block down converter, or LNB. The LNB amplifies the signal bouncing off the dish and filters out the noise (signals not carrying programming). The LNB passes the amplified, filtered signal to the satellite receiver inside the viewer's house.



The Receiver

The end component in the entire satellite TV system is the receiver. The receiver has four essential jobs:

It de-scrambles the encrypted signal. In order to unlock the signal, the receiver needs the proper decoder chip for that programming package. The provider can communicate with the chip, via the satellite signal, to make necessary adjustments to its decoding programs. The provider may occasionally send signals that disrupt illegal de-scramblers, as an electronic counter measure (ECM) against illegal users. It takes the digital MPEG-2 signal and converts it into an analog format that a standard television can recognize.

Since the receiver spits out only one channel at a time, you can't tape one program and watch another. You also can't watch two different programs on two TVs hooked up to the same receiver. In order to do these things, which are standard on conventional cable, you need to buy an additional receiver.

Input and receiver

In our project we used an IR remote as an input device which sends an IR pulse to the receiver. The receiver is a photo transistor which detects the light from the IR remote. The output of the receiver commands the microcontroller.

Controlling part

The controlling part in our project is microcontroller. The microcontroller receives digital input from the photo transistor. It processes different functions according to the number of buttons on the remote programmed by the user. The output of the microcontroller is used to drive the motors through the relays.

Output part

Our project output part consists of:-

- Horizontal movement(azimuth):- the motor is driven by the microcontroller through relay to move from east to west (right to left) and vice versa
- Elevation:-the other motor is driven by the microcontroller through relays to move from north to south and also vice versa
- Stop:-whenever the desired position acquired the microcontroller will stop the motors.

Material Used

Infrared Remote Control Device

The infrared remote controller was composed of infrared remote control transmitter and infrared remote control receiver, shown in Figure 3. 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 constitute input circuit of keyboard commands with pulse generator in the IC1 and signal encoder in the keyboard.



IR Receiver

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.

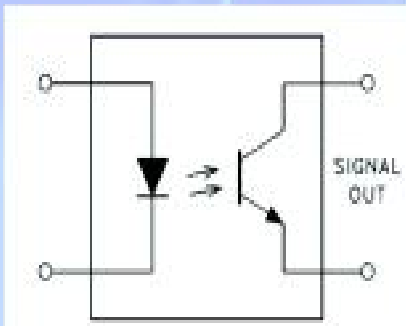


fig. IR Sensor

Description of Signals of the IR Transmitter and Receiver

IR sensor module receives the IR pulses sent from remote and converts it to corresponding electric pulses. These electric pulses are given to microcontroller that decodes it to corresponding data byte using zero crossing detectors 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.

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 is shown in Figure below.

It is supported to drive over 250 kg loads, when only driven by 36V DC motor. Now we are using 12v DC motor.



FIG.4. YURI 518R servomechanism

Wipers DC motor

Wiper motors are normal DC motors. There are 12V and 24V wiper motors. Wiper motors are designed for two speed operation. The motor consists of three brushes namely; common, low speed and high speed. Two of the brushes will be supplied for different mode of operation.



FIG.5.DC wiper motor

In this project a 12v wiper motor is used for azimuth rotation. It has the ability to start the engine of a car so it can simply support the weight of whole system.

RELAY

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. . The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as



shown in the diagram. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

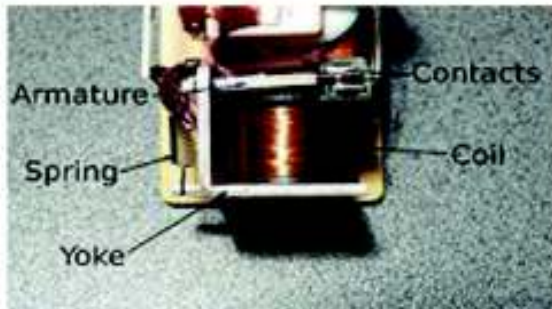


Fig.2-14. Basic relay design

Conclusion and future enhancement

We found difficulties in finding equipments such as stepper motor of 12v and motor drive of 10A. In order to overcome these difficulties, we replaced the stepper motor by a normal servo motor(12v) and also build a circuit board to replace the motor drive.

* In the future the project can be updated by installing a GPS tracker along with the micro-controller to enable and fetch satellite degrees from the GPS satellite to the microcontroller. In our project we used a counting system in the program but in the future we can use a degree reading system in the program for 100% accuracy. This makes the system a closed loop controlling system.

* The wiper motor will be replaced by stepper motor.

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- 4) SAMRAWIT ABRHALEY





SUSPENSION BRIDGE IN MASSAWA

Bridge is a structure which provides passage facilities over an obstacle without closing the way underneath. The required passage may be for a road, railway or pedestrians. Bridges are important to everyone, but they are not seen or understood in the same way by everyone, which is what makes their study so fascinating. Like in business community the bridge is seen as opening up new markets and expanding commerce. An artist will consider the bridge and its setting as a possible subject for a future painting. A boater on the river, looking up when passing underneath the bridge, will have a complete different perspective or view. Everyone is looking at the same bridge, but it arouses different emotions and visual images for each one of them. Bridges don't just happen; they must be planned and engineered before they get constructed.

The proposed site is located within the city of Massawa, which is the largest port and one of the tourism attractions in Eritrea. The proposed bridge is between the areas of Grar and Wushti batse. Habitats of the area travel around the Twalet back and forth in their daily activities for 9km. The proposed bridge span is 500m long. There are different types of bridges. From safety, economic and aesthetic point of view suspension bridge was found suitable for this proposal. Suspension bridge captures the imagination of people everywhere, with their tall towers,

slender cables, and tremendous spans; they appear as ethereal giants stretching out to join together opposite shores. As the site is found between the free zone areas, the bridge gives extra aesthetics to the area making it attractive to the tourists.

Major reasons for proposing a suspension bridge

- * To simplify the traffic flow
- * Easy access between the two shores including reduced travel time.
- * Serves as a link between the two free zones.

Objectives of this project are

- * to solve the transportation problems. The traffic flow of vehicles and pedestrians across the sea in the urban area should be unobstructed. Therefore to provide proper transportation requirements, it is necessary to determine the proper width of the bridge to obtain optimum traffic flow conditions, considering the complexity of the adjoining streets and the existing, as well as the expected, traffic volume. Further, it is necessary to evaluate the most convenient type of approaches to bridge, considering unobstructed traffic flow conditions from all the direction leading to the bridges
- * The bridge should be located to serve the traffic best. The location and layout of bridges depends upon traffic conditions. Generally speaking city bridges influence the landscape or transform the general character of a city.
- * The cost of the bridge should be economical. Suitable locations and structural concept of the



bridge are essential to maintain urban bridge economy.

The following expectations will be met after the accomplishment of the project,

- * The bridge will accommodate a large traffic flow including heavy vehicles which will provide a safe service for the Massawa port service, Import and Export, in which the whole country will benefit from the project.

- * Trade and commerce will develop due to this bridge because the living area of Massawa is found on one of the shores. As the bridge will give the shortest path between the two shores, it will motivate the urban planning to increase and spread around.

- * It will also reduce overcrowding of traffic volume along Sigalet Ketan Bridge during different kinds of ceremony and during busy port services.

- * It will promote the residents of the city for easy transportation system and easy access to different kinds of commercial buildings and hospital etc...

Site investigation were held to collect the following data,

- * Probable span length

- * Preparation of topographic map

- * Land feature which could be affected by the proposed bridge

- * Layers of soil

- * Construction materials

Elements of the suspension bridge design are:

- * Site selection

- * Suspension bridge system

- * Loads and load combinations

- * Structural Analysis

- * Detailed design

- * Connection between the structural parts of the suspension bridge

- * Environmental impact

Bridge site selection : The site selection of the bridge is governed by engineering, economic, social and aesthetic considerations. As the ideal bridge requirements are not available on ground a least objectionable site had to be selected based on engineering judgement. One major factor that governs the alignment is the roadway approaching the bridge. Geometrically, bridge is just a small part of the highway. From the driver's standpoint, bridge need to blend with the road.

Suspension Bridge System:

Cable System - The main cables are made up of galvanized bridge wires which are placed in strands and compacted together.

Towers - The towers are multistory frames that support the reaction of the cables.

Stiffening Trusses - The purpose of stiffening trusses is to distribute the concentrated loads, reduce load deflection, and secure the aerodynamic stability of the structure.

Loads and Load Combinations

Different loads were considered in combination. The types of loads considered were dead load, live load, wind load, tidal loads and earthquake load. The critical load combination was taken by analyzing the structural system under different load combination. Different positions of the trucks were considered for generating the maximum moment, shear force and axial load on truss, towers cables and foundation.

Design of Anchorages

Design of anchorages were done with respect their loads and support mechanisms.

- * Anchorage support width design

- * Abutment stability check

- * Abutment back wall and stem design

- * Abutment Footing design

- * Abutment wing wall design

Design of foundation

Pile groups were used for the foundation. The following elements were analyzed and designed.

- * Pile group capacity, Pile spacing and arrangement, Load distribution and Pile detailing.



Connection between the main parts of the suspension bridge -

Connection are those components that make the structural system act as one. The following were designed.

- * Connection between Main cables and Hangers
- * Connection between Main cables and Deck
- * Connection between Main cables and Anchorages
- * Connection between Main cables and Towers
- Environmental Impact
- * As a suspension bridge is a mega structure it acts as an icon for tourism.
- * Provides easy access for both traffic and pedestrian flow.
- * It promotes trade and commerce

Design method and code of practice used

- AASHTO LRFD
- ACI Code
- BS Code

Challenges that need further improvements

- * As there were no funds for this proposal the site visits arranged were not enough
- * Subsoil and geotechnical investigation were not carried out because of its cost.
- * Topographic map prepared was not sufficient for detailed analysis and design
- * Enough senior consultants didn't participate. As this type of bridge isn't common in our country enough knowledge was not available.
- * Lack of tutorial for using the software and design itself.
- * Not enough software was available.



Softwares and Tools used

Autocad 2007, 2009 and 2012
STAAD.Pro V8i
ArcGIS
SAP
Excel Spreadsheets.

REFERENCES

- * AASHTO LRFD Bridge design specifications
First Edition
SI Unit 1994 & 2012
- * Highway and Bridge Engineering
B.LGUPTA AND AMIT GUPTA
- * Design of highway Bridge (Based on AASHTO
LRFD Bridge specification)
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- *Other miscellaneous materials from internet
and Google.

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