42nd Jawaharlal Nehru National Science, Mathematics and Environment Exhibition for Children

Structure and Working of Exhibits

16-22 December
2015

JNNSMEE 2015
MUVATTUPUZHA - KERALA
16 - 22 DECEMBER 2015

विद्यया ऽमृतमश्नुते
एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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Preface

The learning of Science and Mathematics are instrumental in developing well-defined abilities and skills such as spirit of enquiry, creativity, objectivity, logical thinking and aesthetic sensibilities among children. Children learn through interactions with the environment around, nature, things and people. They actively engage with the world around them in exploring, responding, inventing, working things out and interpreting. Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children offers an opportunity to children to express and exchange their creative ideas with joy of scientific investigation. It helps them to learn the methods of science and mathematics, provide them with opportunity to develop their problem-solving skills and creative abilities.

The National Council of Educational Research and Training (NCERT) organises the Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children as an annual event in collaboration with a State or Union Territory. The JNNSMEE is the culminating activity of a series of exhibitions organised at school, zonal, district, regional and state levels. A large number of students and teachers participate in such events.

The present publication, 'Structure and Working of Exhibits' includes write-ups of a few exhibits selected for display in the 42nd JNNSMEE–2015 which is being organised in collaboration with the Ministry of General Education, Government of Kerala at Nirmala College Campus, Muvattupuzha, Ernakulam, Kerala during 16–22 December 2015. Other materials like 'List of Exhibits' which contains the titles and synopsis of exhibits selected for participation in the

JNNSMEE–2015 along with information brochures stating objectives and other details of the exhibition have also been published. It is expected that these publications will motivate and help children to participate in future Exhibitions.

The write-ups included in the present publication were selected out of the entries received from all the states/UTs and other organisations. These were reviewed and edited by an expert committee in the Department of Education in Science and Mathematics, NCERT.

Completing the task related with the editing and publishing of this booklet has been possible because of the continuous efforts of my colleagues Shri R.R. Koireng, Dr. Rejaul Karim Barbhuiya, Dr. Rachna Garg and Dr. Alka Mehrotra. I also thank for Dr. Gagan Gupta for coordinating the task Further, I thank Mr. Sarfaraj Ahmad for helping the department in bringing out this booklet.

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Professor and *Head*
Department of Education in
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National Council of Educational
Research and Training

New Delhi
22 November 2015

Contents

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1

FERTILISER FROM EGG SHELL

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Sangthanmawii

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TEACHER
Y. Dilip Kumar Singh

INTRODUCTION

Plants usually grow healthy at pH 5.5 to 7.5 level and below this pH level plants can't grow properly. For proper stabilisation of soil, stabilising agents are needed but it should not affect the environment. Plants need air and water inside the soil for their growth, but in dry land, air and moisture inside the soil are very less.

Eggshell can be used to provide enough calcium in the form of calcium carbonate which neutralise the acidic soil.

Charcoal from plants also provides tiny pores where air and water molecules are trapped and make air and water available to plants. The carbon dioxide release is trapped by charcol under chemisorptions and converted into organic matter and charcoal itself does not degrade into carbon dioxide but remains as carbon in organic matter for long time thus, without losing the quality of soil.

SCIENTIFIC PRINCIPLE INVOLVED

1. Neutralising the acidic level of soil - Calcium Carbonate (90.1% to 91.1%) of eggshell neutralizes the acidic soil.

   $CaCO_3$ + Acid (organic/mineral) $\rightarrow$ Salt + CO_2 + H_2O

   ↑ from eggshell ↑ from soil

   The CO_2 is again trapped by the surface of charcoal and converted into organic matter as a long process (part of carbonisation). This process is eco-friendly and can be an effective way for controlling global warming.

2. Charcoal has tiny pores where air and water molecules get trapped, which can be utilised by plants.

Material Required

Waste eggshell, charcoal, acidic soil.

Preparation

The eggshells are cleaned and it is made into powder. Similarly charcoal is also made powder. The two materials are mixed depending upon the condition of soil i.e. pH level and quantity of the soil.

Mathematics for Calculation of Calcium Carbonate and Charcoal quantity

1. **For $CaCO_3$:** Acidic level of the soil is tested in per cm^3 or m^3 from different spots of the specific land area up to 20 cm deep. Let Y gm of $CaCO_3$ be the amount required for neutralising $1m^3$ of a land area, then the amount of $CaCO_3$ needed for X m^3 of a land area= $Y \times Xg/m^3$
2. **For Charcoal:** According to Dr. Guo research report, 5 per cent of charcoal is needed for 100 metric tons cubic of soil up to 20 cm deep. Therefore the amount of charcoal needed for X metric tons of a land area is $5 \times X/100$ metric ton.

Advantages

i) Raw materials are very easily available.
ii) The method is very simple, any gardener or farmer can do it and it is eco-friendly.
iii) Low cost.
iv) It is totally waste material management.
v) It is more suitable for dry land and hilly region having less rainfall.
vi) It is better than lime stone and bitumen, which are used as soil stabilising agent.

Limitation

This method is mainly suitable for acidic soil and not for alkaline soil.

Applications

i) It can be applied to a variety of plants like tomato, potato, rice, pea, wheat in which mineral content needs to be increased.

ii) The calcium extract can be used as a laboratory reagent for practical purposes in schools and colleges.
iii) The calcium extract can be used for food processing like chewing gum and cosmetic industries.
iv) The calcium extract can be used for the treatment of OSTEOPOROSIS as it increases the density of bone. (Japanese research finding report)

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2

Hermetia Sanitising Bioconverter

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TEACHER
Smita Sarjerao Patil

Introduction

By using this model, we produce black soldier fly larvae. Basically this model is useful for establishing and building larvae colonies. The black soldier flies are allowed to lay eggs in small holes over the grub bin. The black soldier fly holds much promise for converting low value manures and many other organic waste into a valuable commodity. In this way amount of waste products or garbage are reduced.

This larvae are edible and are also best at quickly converting 'high- nutrient' waste into animal feed. Black soldier fly are better at converting high cellulose materials (Paper, cardboard, leaves, plant materials except wood) into an excellent soil amendment.

Process

Black soldier fly larvae (BSFL) are used to compost and sanitise wastes, and/or convert the waste into animal feed. The harvested pupae and prepupae are eaten by poultry, fish, pigs, turtles, dogs etc. 'The wastes include fresh manure, food wastes of both animal and vegetable origin

Fig. 1: Biopode

Construction of Biopode

This is our home made Biopode. This is also used for house-hold sanitising purpose.

First we take a plastic bucket. In the lower part of this bucket a plastic hole boll is attached. Then we put the layer of filter (scoth bright). For ventilation purpose around the round side of the unit a well crow is attached.

PVC pipe is also attached to the bucket and the box as shown in Figure 1. We put animal food in that box and the second pipe is used as outlet for sanitation purpose.

Working

Black Soldier Fly (Hermetia illucen)

Fig. 2: Black Soldier Fly

The black soldier fly or Hermetia illucens is a common and wi despread fly of the family stratiomyidae,whose larvae are common detritivores in compost heaps. Larvae are also sometimes found in association with carrion, and have significant potential for use in forensic entomology.

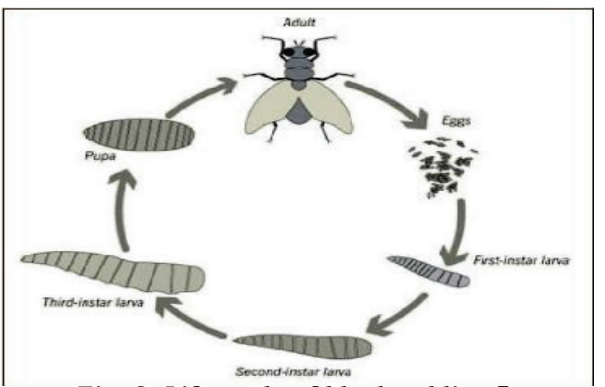

Fig. 3: Life cycle of black soldier fly

Black soldier fly larvae(BSFL) also known as "phoenix worms" may be used in manure management, for house fly control and for the bioconversion of organic waste material. Mature larvae and prepupae raised in manure management and waste bioconversion operation may also be used to supplement animal feeds.

Larvae are sold as feeders for herptiles and tropical fish,or as composting grubs. They store high levels of calcium for future pupation which is beneficial to herptiles

The adult soldier fly has no functioning mouthparts, it spend its time searching for mates and reproducing.

Black soldier fly eggs take approximately four days to hatch and typically deposited in crevices or on surfaces above or adjacent to decaying matter such as manure or compost. The larvae range in size from $\frac{1}{8}$ to $\frac{3}{4}$ inch (3-19mm). Although they can be stored at room temperature for several weeks, their longest shelf life is achieved at 50-60^{O}F (10-16^{o}C).

The adult fly measures about 16mm (5/8inch), has a life span of 5 to 8 days. It is a mimic, very close in size, color, and appearance to the organ pipe mud dauber wasp and its relatives. The mimicry of this particular kind of wasp is especially enhanced in that the fly's antenne are elongated and wasp-like, the fly's hind tarsi are pale, as are the wasp's, and the fly has two small transparent "windows" in the basal abdominal segments that make the fly appear to have a narrow "wasp waist".

Black soldier fly starts inflating its wings during the first 15 minutes after emergence from pupation.

Grub composting bins utilise self-harvesting

The black soldier flies are allowed to carry eggs when the larvae have completed their larvae development, they enter a stage called "prepupae" wherein they cease to eat, they empty their gut, their mouth parts change to an appendage that aids climbing, and they seek a dry, sheltered area to pupate. This prepupae migration instinct is utilised by grub composting bins to self-harvest the mature larvae. These containers have ramps or holes on the sides to allow the prepupae to climb out of the composter and drop into a collection area.

Benefits

- Prevent houseflies and blowflies from laying eggs in the material inhabited by black soldier fly larvae.

- Usually not a pest.
  - Not attracted to human habitation or foods. As a destritivore and coprovore the eggs-bearing females are material food or manure.
  - Black soldier flies don't fly around as much as houseflies. They are very easy to catch and relocate when they get inside a house, as they do not avoid being picked up, and they do not bite or sting. Hermetia illucens only defence seems to be hiding. When using a wet grub bin that will collect or kill all the pupae, the black soldier fly population is easy to reduce by killing the pupae/ pre-pupae in the collection container before they become flies. They may be killed by freezing, drying, manually feeding to Domestic animal, putting the collection container in chicken coop for automatic feeding or feeding to wild birds with a mouse/pest-proof feeder.
- Significant reductions of E.coil 0157:H7 and Salmonella enterica were measured in hen manure.
- Quickly reclaim would-be pollutants. Nine stinky organic chemicals were greatly reduced or eliminated from manure in 24 hours.
- Quickly reduce the volume and weight of would be waste: The larvae colony breaks apart its food, churns it, and produces heat, increasing compost evaporation. Significant amount are also converted to carbon dioxide respired by the grubs and symbiotic/mutualistic microorganism.

3

CLEANING ROBOT

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INTRODUCTION

The Cleaning Bot is made for complete cleaning of any surface-vertical or horizontal.

The model is inspired by our honourable Prime Minister and it is a humble contribution towards his Swachh Bharat Abhiyan.

SCIENTIFIC PRINCIPLE INVOLVED

(i) Conversion of electrical energy into mechanical energy

(ii) Low-high air pressure difference (Vacuum cleaning)

MATERIAL REQUIRED

Sensors, P.C.B, Motors, Propellers, Plastic, Wires, Pipe, Wood etc.

CONSTRUCTION AND WORKING

As per the design, the base is made with strong wood/plastic

- The motor compartment is made. It consists of motors, wheels, battery and I.C. The battery can be charged in two ways ie. by AC/DC current and by solar panels.
- The scrubbing and wiping compartment is made. Scrubber is attached with the motor. The wiper is attached along with sprinkler behind the motor compartment.
- The vacuum compartment is made, by adding vacuum mechanism in front of the bot.
- The robotic arms can be added at its place.
- The cleaning mechanism is added to it so that it can clean vertically also.

- The sensors are installed for better functioning.

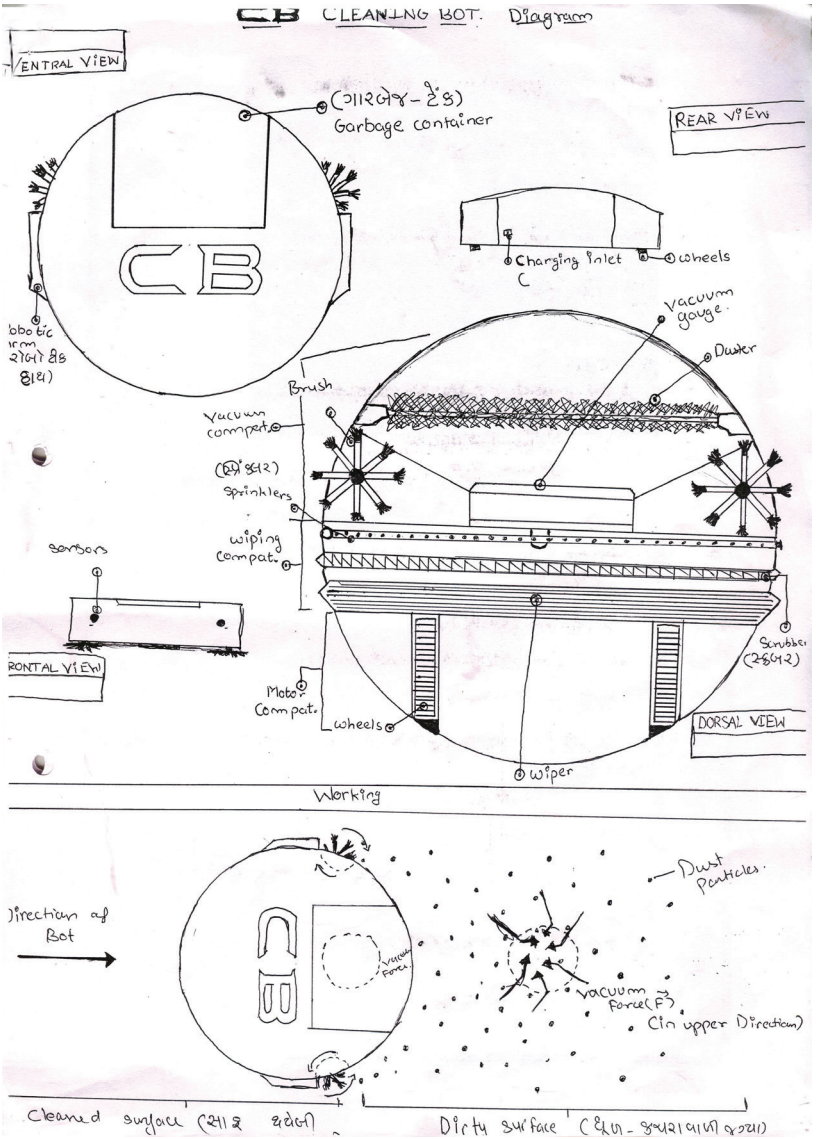

Fig. 1: Cleaning Bot Diagram

In this mechanism, a propeller connected with the motor generates vacuum and absorbs dust particles due to air pressure difference (Vacuum cleaning) . Here, the sensors connected with this mechanism sense the obstacles and divert the path of the

particle accordingly. All dust particles are cleaned and collected in the tank located in the upper part.

Garbage having big size, bags, plastic wrappers etc act as obstacles for a sensor and path is diverted by it. However, in future, such mechanism can be developed by putting a high power vacuum cleaner to collect such type of garbage.

At the same time, this device does the scrubbing with the help of scrubber attached with motor. Wiping is also possible with the wiper attached along with sprinkler behind the motor compartment. In this way, this device can do cleaning, scrubbing and wiping at the same time like a Robot. So it is named Cleaning Bot.

APPLICATIONS

i) This device can be used as vacuum, scrub and wipe any surface without wasting time. Vertical cleaning is possible. Obstacle recognition is also possible

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4

Buoyancy Engine

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Introduction

As fossil fuel is non-renewable and limited, we need to find new ways to generate eco friendly & green energy. The model introduced in this project can be a part of our existing renewable energy projects, for example-solar, wind and hydel energy. These together can solve our energy crisis. This exhibit demonstrate the working of generating power from high and low tide in the water bodies.

Scientific Principle Involved

This exhibit works on the "Archimedes Principle" which states that any object, wholly or partially immersed in a fluid, is buoyed by an upward force equal to the weight of the fluid displaced by the object.

Material Used

Pulleys - 5; Heavy base -1; Balloon - 3; Transparent bucket-1; Nylon thread -1;

Construction

Fix four pulleys to the base and one to the balloon as shown in Figure 1. Take three inflated balloons, the first two should be indentically inflated. The third balloon should be smaller than the other two.

Attach the nylon thread to all the three balloons through

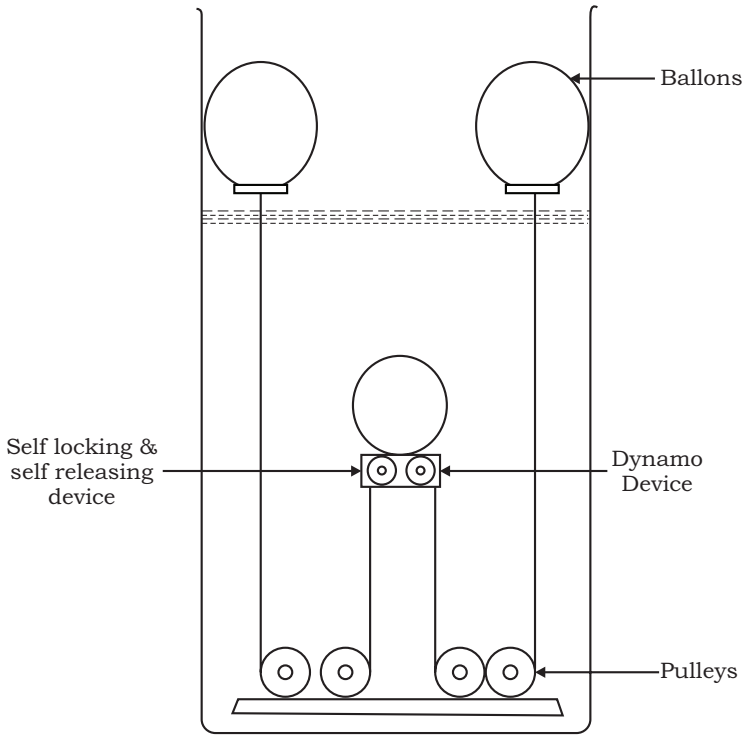

Fig. 1: Buoyancy Engine

all the pulleys as shown in the figure 1. Place the assembly in the transparent bucket filled with water. Make sure all the three balloons (two identical, one small) are floating at the same level in the water.

WORKING

When we increase the level of water in the bucket (simulated high tide) the two balloons which are more inflated (larger) rise along with the water level, while pulling the smaller balloon down below the water level. When the water level is decreased (simulated low tide) by removing the water from the bucket, the two larger balloons come down with the water level and the smaller balloon rises. Now we need to device a self locking mechanism which will lock the smaller balloon pulling it towards the ocean floor storing potential energy, when the high and low tides take place in the ocean. The self releasing mechanism will release the balloon and let it rise all the way to its previous position generating electricity with the dynamo device attached to the balloon.

5

ADVANCED AIRFOIL DESIGN

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TEACHER
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INTRODUCTION

The project is aimed towards the conservation of energy resources and making them available for future generations. It tries to capture the true meaning of sustainable development.

By enhancing the current technology using the existing principles of physics, this project focuses on meeting the energy demands of the future by harnessing wind energy.

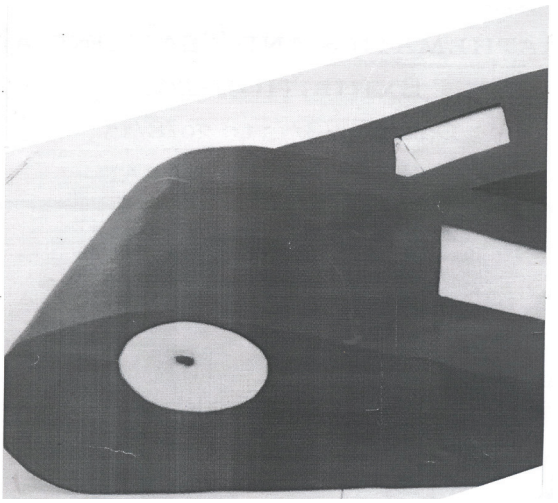


Fig. 1: Advanced Airfoil

Scientific Principle Involved

The scientific principle used in the project is mainly the Bernoulli's principle which state that in fluid dynamics, for an inviscid flow of a non conducting fluid, an increase in the speed of the fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy. In other words, in a streamline flow of any fluid the potential energy, pressure and the kinetic energy at every point is constant.

The above principle along with the principle of power generation from wind energy and Magnus Effect would pose a potential solution to meet the energy demands of the future.

Material Required

Cardboard; Scissors; Plastic propeller fan; Motor; Multimeter; Wires; Wood; Thermocol; Cardboard; Table fan.

Description

An airfoil is a device that provides reactive force when in motion, relative to the surrounding air. Usually the force created is lift because of the pressure differences over the top and bottom surface. Airfoils have many purposes. They produce lift required to keep an airplane in the air, prevent a race car from lifting off the ground at high speeds, lifts a hydrofoil's hull outside the water, and many other. By placing a hole in an airfoil, we hoped to find a new application for an airfoil.

The Idea (Hypothesis)

Our prediction is that by placing a hole in an airfoil's design, we would be able to enhance its functionality to a larger extent. Thus resulting in a more efficient output in various ways.

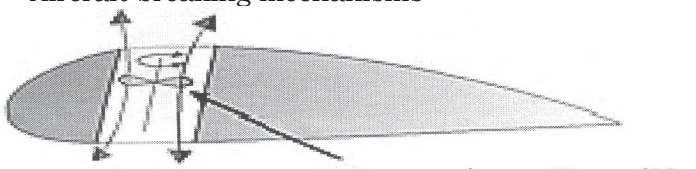
Construction: The airfoil used is the most simplest one, with a innovational idea of introducing a hole in the middle of it. Such that the opening is smaller in the flat side, and bigger in the upper curved part. The modified airfoil is then attached vertically in front of a fan which provides a streamline flow of air. After assembling everything, the two different airfoil (Original & Modified) are tested and readings are taken to compare the efficiency.

Comparing the Two Types of Airfoils

Original:	Advanced:
Less efficient	More effcient
More Drag	Less Drag

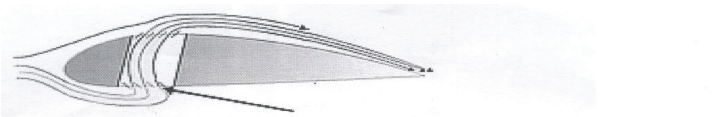
Applications

- Aircraft breaking mechanisms



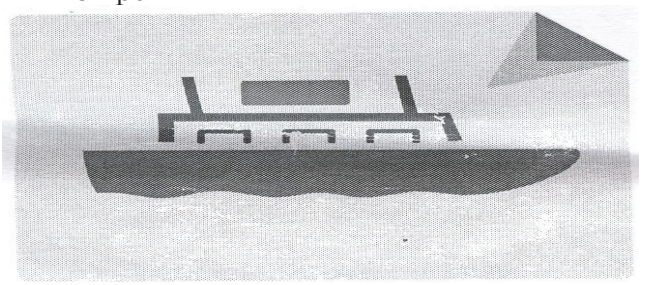
Propeller controlling lift

- Variable lift aerofoil

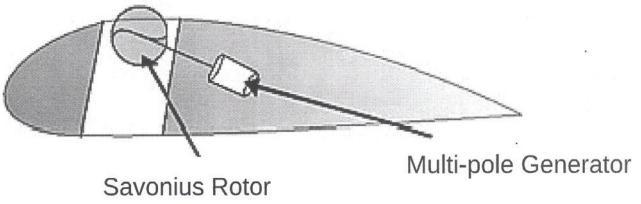


Adjustable Flaps allows air to enter

- In Ships



- Advanced Wind Energy Turbine



Conclusion

Airflow was observed to enter the hole, potentially at a faster velocity. Looking for ways to increase the airflow velocity through the hole even more, endplates and a second airfoil were added to the setup. The results were analysed, and several properties were made for the ideal hole in a wing. Finally, the idea was expanded by applying it to some everyday applications. One of which being a more efficient wind generator.

6

Device for Cleaning and Spraying

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Introduction

Waste materials remain scattered in many places, which contributes to increase in pollutions on earth. Because of this people have to face many health problems. So we thought of developing an exhibit/model to address this problem.

The exhibit can be run without fuel and electricity. It can be run on muscle power only. With the help of this exhibit, we can collect all the waste scattered all over and use it to make earthworm fertiliser and compost fertiliser.

The Exhibit can dust not only insecticide on the gutters but also spray insecticide on the fruiting trees as well as vegetables. It can spray water on the ground to reduce air pollution.

Material Required

An angle stand; 9 inch, 14 inch and 3 inch pulleys; ¾ inches shafts (02 no); 6 inch and 1 inch gears; 4 plastic brooms; exhaust fan; a blower; a funnel; 1 inch PVC pipe, ½ G.I. pipe; a water tank; a waste collecting box/tray.

Construction and Working

An axel is fitted with the help of bearings to the stand. Gears and pulleys are connected to the axel. A handle is fitted to rotate the gears under it. A 9 inch pulley is fitted to the water pump. A blower is fitted to the stand and it is run by gears and pulleys. A dynamo is connected to the stand and attached to the pulley. Magnetic chips are fitted under waste collecting tin box and it is fitted to the stand.

A grinder is fitted to the axel. It will help to sharpen all cutting tools. V belts are used to rotate all the devices at a time.

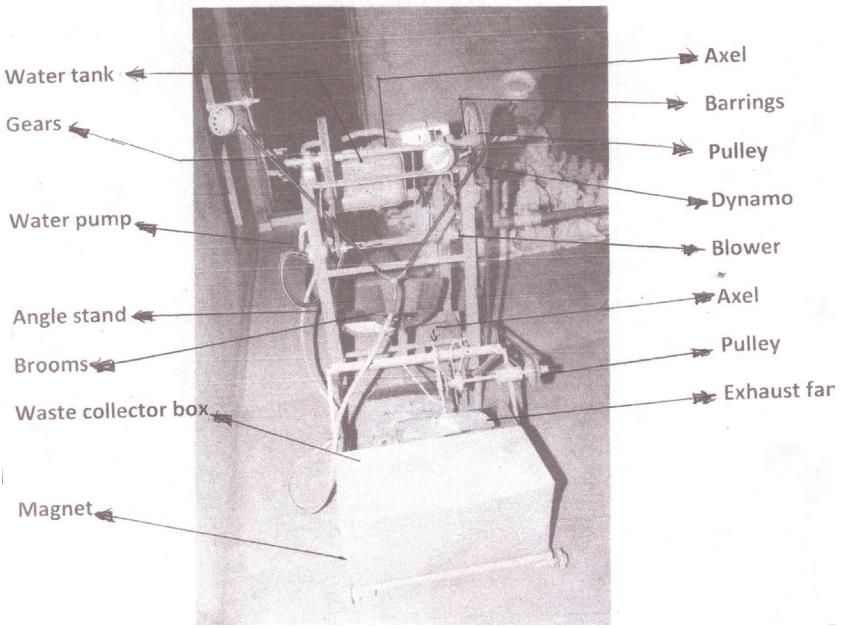

Fig. 1: Waste Cleaner, Water Sprayer and Insecticide Dusting

USES

i) To collect waste on the road:
When the exhibit activates, with the help of handle attached, the brooms collect all the waste in the tin box.

ii) To collect dust:
With the help of exhaust fan, it collects spreading dust in the tin box.

iii) To spray water and insecticide:
With the help of water pump, it sprays water on the road and spray insecticide on fruiting trees and vegetables.

iv) To dust insecticide:
With the help of the blower, it can dust insecticide on gutters on the both sides of roads.

v) To produce electric energy:
With the help of dynamo, it can produce electric energy to charge mobile or other electrical devices.

vi) To sharpen cutting tools:
With the help of grinder, it can sharpen different types of cutting tools

vii) To collects iron materials:

With the help of magnetic chips fitted under the tin box or tray, we can collect iron materials from the road.

All above functions can be completed without using any kind of fuel or electric power.

Benefits

i) This exhibit can be made to do many functions at a time.
ii) The exhibit saves man power energy.
iii) We can produce earthworm fertiliser and compost fertiliser. They will help the farmers.
iv) The exhibit improve social health.
v) The exhibit is made of waste material so it has low cost.

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iv) Shikshan Sankraman
v) Vidnyandeep

7

GUIDE STICK FOR BLINDS

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Murali.B.J

INTRODUCTION

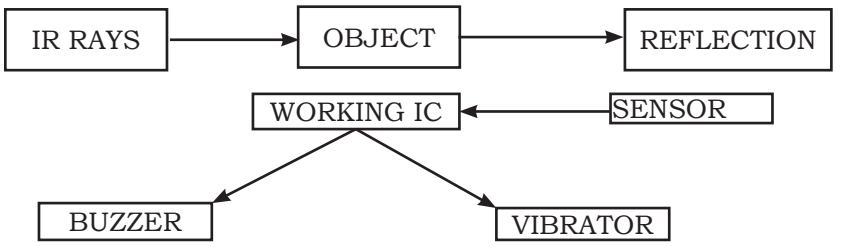
In this exhibit we have prepared an aid for visually impaired (blind's guide stick) using sensor, IR Transmitter-Receiver at low cost. The main concept is that IR-LED Transmitter keeps transmitting IR rays up to some range. IR rays are reflected by object at a certain angle, which falls on the photo diode (IR Receiver) and produces certain voltage for buzzer and vibrator. They produce sound & vibration.

MATERIALS REQUIRED

Sensor-1 (Photo diode); Diode– 2; Resistor– 5; Capacitor – 3; Transistor – 2; IC – Voltage Regulator – 1; Buzzer – 1; Vibrator – 1; Battery 2, Solar Battery with Panel.

CONSTRUCTION

To prepare blind's guide stick we used long PVC pipe, at the bottom of which, the IR transmitting LED and photo diode are placed. IR receivers are kept at the bottom to detect any object by the visually impaired person. Switch is installed at the top of the stick near the hand. The vibrator and buzzer are connected to sensor which is kept at the top of the stick near the hand. The Red LED indicator is fitted at the middle of the stick for the safety purpose, which works as a indicator during the night time so that any body walking nearby can identify the person. A small wheel is connected to stick at the bottom for smooth walking. There is a horn kept on the stick for the impaired person.



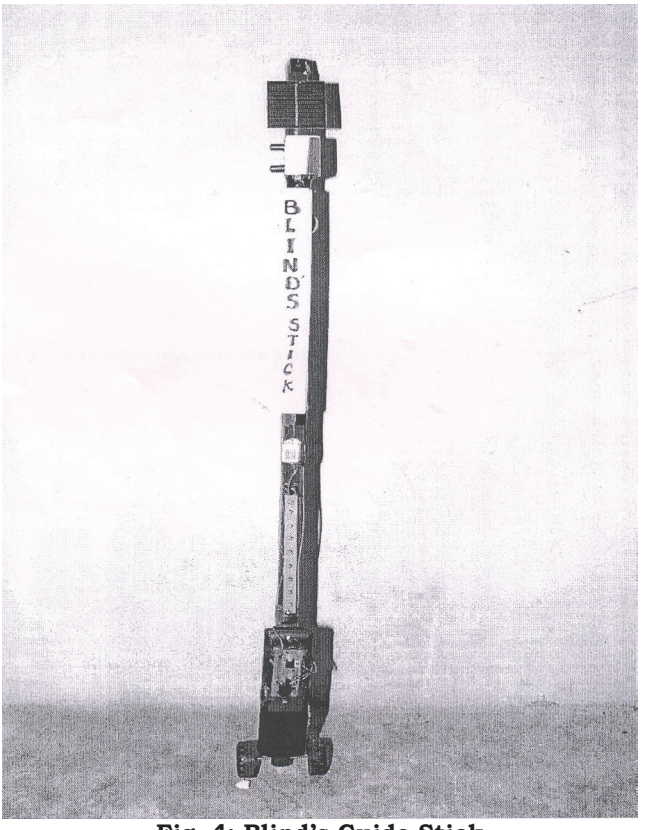


Fig. 4: Blind's Guide Stick

WORKING

The IR- Transmitter transmits IR rays using 5 volt power from the battery and the diode will glow during IR emission like television remote control. Then there is another IR receiver which is called photo diode to receive IR rays from the IR transmitter. When IR transmitter transmits rays it will be reflected after falling on the object at a certain angle, and finally falls on IR

receiver. The receiver is connected to buzzer and vibrator. When IR receiver receives ray it turns on the buzzor and the vibrator thereby making sound and vibration respectively.

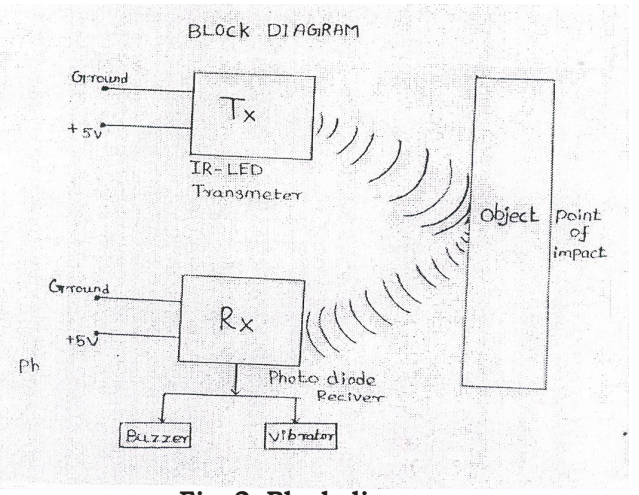


Fig. 2: Block diagram

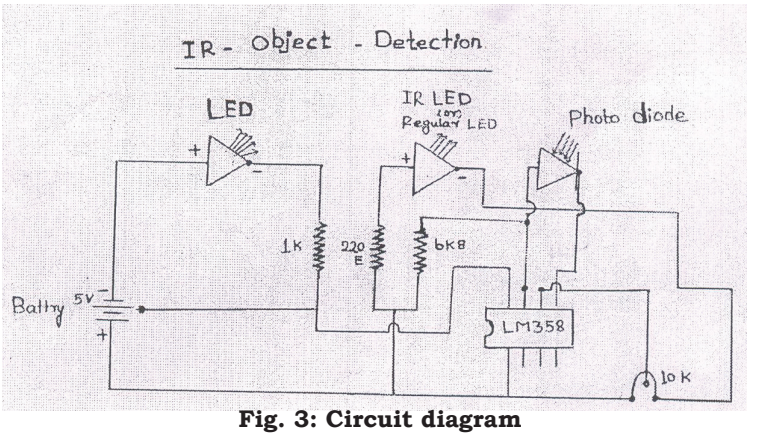


Fig. 3: Circuit diagram

Logical Truth Table – Conjunction Table

P (Object)	Q (Sensor)	P Q (buzzer & vibration)
T	T	T
T	F	F
F	T	F
F	F	F

Applications

i) It is used as Blind's Guide Stick
ii) This system can also be used in the security system such as banking, railway, defence, school etc.

Conclusion

It is prepared using low cost material and it is easy to carry and operate by the visually impaired and they can walk without any one's help.

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i) Class XI & XII Mathematics, Text Books (TN STATE BOARD).
ii) Class XI & XII Physics Text Books (TN STATE BOARD).
iii) Class XI & XII Computer Science Text Books (TN STATE BOARD).
iv) Product Cordial Labelling of Graphs.

8

WIRELESS POWER TRANSMISSION

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INTRODUCTION

The basic idea behind Wireless Power Transmission (WPT) is that it transmits energy from one place to another without using wires. In conventional electrical energy transfer almost 30 per cent energy on an average is lost due to resistance of the wire (in India it exceeds 40 per cent) and also it requires wiring. Also some parts of machines require rechargeable batteries to power up. Wireless transmission makes it possible to charge up the equipment while in motion or without accessing the chargeable component.

This project makes it possible to reduce the complexity of wiring, expenses of wires and minimising the resistive loss and the loss of electrical energy in step up /step down transformers used for transferring AC from one place to another where almost 80 per cent magnetic energy is lost in the ferrite core.

SCIENTIFIC PRINCIPLE INVOLVED

The basic idea is Faraday's law of electromagnetism where relative motion is required between the wire and the magnetic field in order to generate induced e.m.f.

Here we have not used any magnet nor there is a relative motion between the coil and the magnetic field but we reproduced the condition i.e magnetic flux change with the help of an AC Oscillator having10 KHz to 100 KHz AC through the BIFILAR PAN CAKE COIL.

As,[$E \propto \frac{\partial \phi}{\partial t}$ [E=induced e.m.f and $\frac{\partial \phi}{\partial t}$ is the rate of change of magnetic flux]

So as the frequency of the AC is increased the value of $\frac{\partial\phi}{\partial t}$ changes significantly and produces a significant amount of e.m.f for driving any electrical equipment without using long wired coil thus reducing the loss.

The amount of magnetic field can be increased or decreased with the following parameters.

i) $B \propto \partial\ell$ [B= magnetic flux and $\partial\ell$ is the length of the wire].

ii) $B \propto I$ [I= Current]

iii) $B \propto \text{Sin}\theta$ [θ is the angle between the magnetic field and the wire]

iv) $B \propto 1/r^2$ [r= distance from the wire]
Also there is a phenomenon we have noted during our project development i.e if the cross section of the wire is increased, the magnetic field increases.

v) $B \propto A$ [A is the cross section of the wire]

Material Required

Two wire cable (for BIFILAR PAN CAKE coil making purposes); Faviquick glue; Cello tape and insulator tape; N-P-N (2N2222 or TIP35C) Switching transistor; BD 139 Transistors; 470 Ω 5 Watt, 68 Ω, 1KΩ Resistances; 555 IC; Connecting wires; LEDs; Torch Bulb; DC Motor; Bridge Rectifier and 5.1 Volt Zener diode; 100µF, 470µF Capacitor; 12 Volt 500mA DC Regulators; Wooden Switch Board (10" X 18") with plastic top; Card Board, glue and colored papers; Crocodile clip.

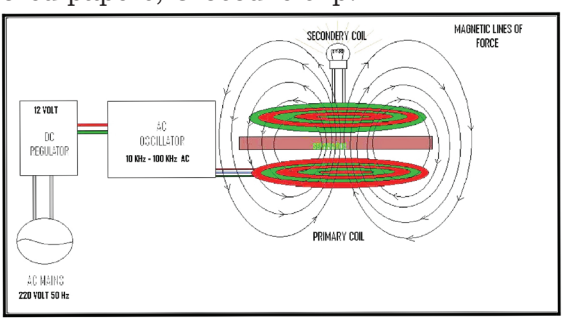

Fig.1: Block diagram of wireless power transmitter.

Construction and Working

i) Bifilar Pan Cake Coil

First we spiralled the two wired cable in concentric circles to

make the coil and then applied feviquick to every turn to hold them in place. After the glue dried out, we made the second concentric wire winding around it and again doing the same process again and again to have the desired shape of the coil.

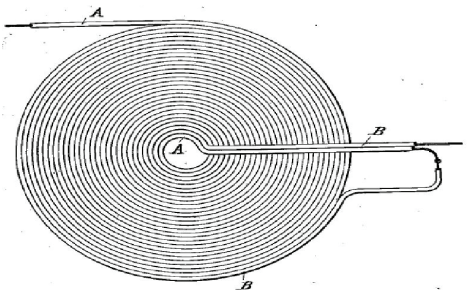

Fig. 2: N Tesla

Then as there are two ends having two wires suppose blue and red wires, we connected the outer blue with the inner red and concealing them with insulator tape and getting only one from it and getting two other from the other two so having a total 3 (A,B & C)wires as shown in Figure 3. This is our PRIMARY COIL.

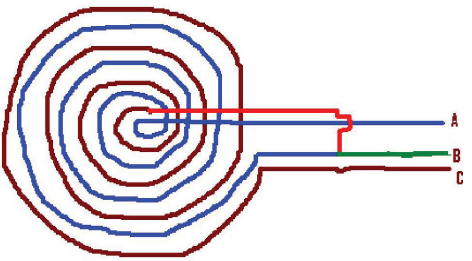

Fig. 3: Primary coil

The construction of the secondary will be same like the primary coil but there is a little bit difference as the second wire previously known as B is omitted and only two ends A & C are required to get the output as given in the figure 4.

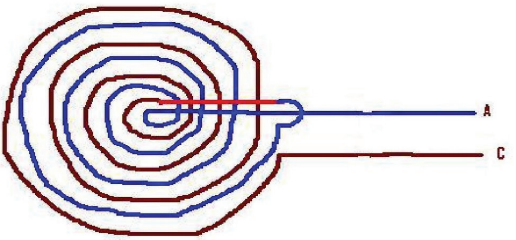

Fig. 4: Secondary Coil

ii) CIRCUIT :- We connect the primary coil's A to the collector of the N-P-N transistor and the C to the base and connecting a 470Ω 5 Watt resistor in series with it and connecting the B with the +ve source and the –ve with the emitter of the transistor as shown in figure 5.

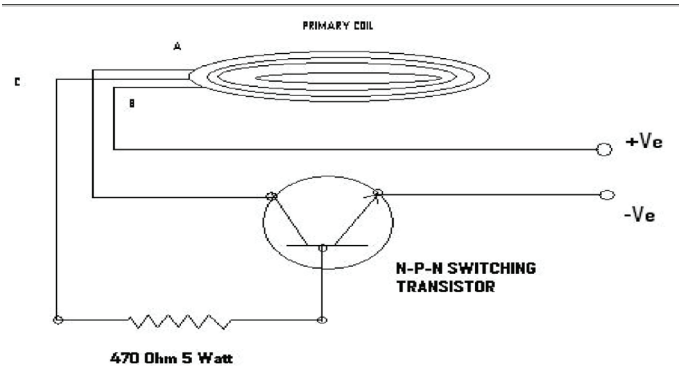

Fig. 5 : AC oscillator circuit

Then we put the coil and the circuit in the wooden switch board and keep the coil attached with the plastic top of the switch board with the help of cello tape. It is necessary to attach a heat sink with the transistor as it might get overheated during the operation.

Now the secondary coil can be connected to any apparatus requiring electrical power. If it needs AC so no conversion is needed and if DC is required, that can be achieved by connecting a bridge rectifier at the two ends of the coil. The number of turns can be determined as per voltage requirement. The circuit connection is given below in Figure 6.

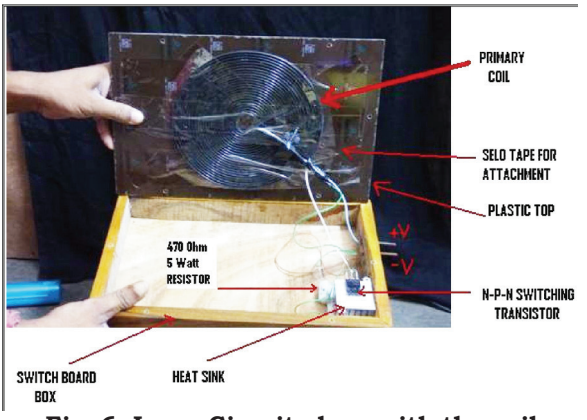

Fig. 6: Inner Circuit along with the coil

APPLICATIONS

This exhibit has a wide ranging applications. These are as follows:

i) Electrical automobile charging (static or moving).
ii) Consumer electronics (Cell phones, shaver, fans, lights etc.
iii) Industrial purposes for charging equipments not accessible easily.
iv) Transmitting electrical energy in harsh environment and energy to remote areas.
v) Solar energy harvesting satellites to produce directed magnetic field towards earth's specific region for reproducing electrical energy for daily use.
vi) To recharge pacemakers without operating.
vii) To recharge nano robots in our body (in future)
viii) May be in future to broadcast energy globally.
ix) May be using all other nations' satellites in one direction to resist solar storms.

REFERENCES

We took reference from the following web sites and our Physics teacher Sri SASANKA MAJUMDER and we conducted experiments with the coil for the last six/seven months using different approaches and at last found a cheap and efficient way of doing this.

i) http://www.teslauniverse.com/nikola-tesla/patents/us-patent-512340-coil-electromagnets
ii) https://en.wikipedia.org/wiki/Bifilar_coil
iii) http://jnaudin.free.fr/gegene/indexen.htm

9

Banana Leaf- An Alternate to Plastic

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Introduction

This is a novel eco-friendly technology to preserve leaves green for one year without using any chemicals and to minimise the usage of plastic and paper worldwide. It creates a unique material as a substitute for plastic using leaves by extending some of its properties like durability. It is a patented technology. These products are completely eco friendly, tested and suitable for human use. This technology could save 30 million trees per annum.

Primary Concerns

- No technology for the preservation of leaves for about a year without chemicals.
- No perfect replacement for **plastic** and **paper.**
- Deforestation, climate change and habitat destruction.

Description

Naturally leaves don't stay long. When we pluck out leaves from plants, they dry out in a few days and are generally thrown away as waste. There was no technology to preserve leaves without chemicals.

This technology preserves the leaves for one year with green colour and 3 year without the color. This technology increases crushability, durability, stretchability, resistance to extreme temperature of banana leaf and make it phathogen free and convenient to make eco-friendly plates, cups, wraps. We can

replace similar products which can reduce up to 59 per cent of plastic, 18 per cent of paper products. These products were tested for its physical & chemical properties.

Process

This technology consists of seven physical processes, for making leaves to stay long and gives amazing characters and properties which have no substitutions. It preserves and protects leaves from pathogenic agents thereby preventing the microbes from living in the leaf thus keeping it green.

P1: Process Green for 3 hours – Chloroplast presence
P2: Process Kill for 2 minutes – Freezing the cell activites
P3: Process DM (Duration vary according to area) – Temper ature
P4: Process Sterilise for 1 minute
P5: Process Air for 6 minutes – Stabilise
P6: Process Resist – Pathogenic resistant
P7: Process UV for 60 seconds – Safe

Working

In the first process, the ***cell walls become swollen.*** This process is responsible for the ***green color*** in leaves. This techique ***damages the membranes*** of the cells without allowing the pigments to be leached out of the cells. This kills the cells and softens the leaf. This technique is responsible for the stretchability and makes the leaves more convenient to produce utensils.

It damages the cell membranes and decreases dry matter in leaves. It also ***reduces the chemical reaction*** in the leaves which cause spontaneous combustion. It is responsible for the extreme ***temperature holding capacity*** and sterilises the leaf.

Fig. 1: Normal banana leaf after 3 days

This technology also makes the cell wall to ***expand and becomes puffy*** and make it resistant to pathogens and safe for humans and animals.

Applications

Banana Leaf Products (Utensils)


- Plates
- Cups
- Box, Containers, Bowls
- Packaging and Wraps material
- Cone (Ice Cream and Popcorn)
- Envelopes (Postal and Tablet)
- Writing medium - Paper (Decolourised)



Comparative Analysis				
Properties M. Tenith Adithyaa	Our Banana Products (12)	Petroleum Plastic (5)	PLA Film (5)	Paper (5)
Eco-friendly	Yes	No	No	No
Flexibility	Yes	Yes	No	Yes
Biodegradability	Yes	No	Partial	Yes
Electric resistance	Yes	Yes	Yes	Yes
Hydrophobicity	Yes	No	Yes	No
Crushability	Yes	Yes	Yes	Partial
Animals Fodder	Yes	No	No	No
Chemicals Free	Yes	No	No	No
Safety – NON TOXIC	Yes	No	No	Partial
Flammable	Yes	Yes	Yes	Yes
Healthy	Yes	No	No	No
Pathogens Free	Yes	Yes	Yes	Yes 29

Safety

- 100 per cent safe – Contains organic compounds only.
- Chemicals Free.
- Pathogenic resistant.
- Ultra Violet treated.
- Sterilised (Steam & Heat).
- Practical experiments for about 3 years.

Health Benefit

- Banana leaves = large amounts of polyphenols (natural antioxidants).
- Polyphenols affect human cells, increases the oxidative process and prevent diseases.

Future Scope

- This technology can be improved by altering some process and can find various other applications.
- Life span of leaves can be increased by repeating DM
- More amazing properties can be attained when research expanded to ultra cellular level.

Conclusion

- It can pave way for further research in plant physiology – particularly leaf.
- We have successfully created a technology capable of preserving banana leaves for about one year with its green colour.
- Biodegradable, EDAX and pathogenic test proved it is degradable, chemicals free, safe and act as animal fodder.
- By implementing this technology, we can save 59 per cent of plastic, 18 per cent of paper and 30 million trees per annum.
- It doesn't alter the structure of the leaf.
- The technology and products have many applications, yet many are unknown.

10

A Mathematical Stride

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Introduction

The least sum of distances to three points created a sound stride in the field of mathematics. Being the language of science, mathematics paved the way for a lot of inventions and hence, any movement in the field of science became unavoidable without it.

This model exposes some unknown, rare, interesting and useful concepts through practical observations.

We hope this indomitable effort helps the viewer to make a motivational approach towards the subject and create a positive attitude, as it can be useful in our daily life.

Materials Required

Plywood; Paint; Charts; Reapers; Burettes; Caps; L.E.D. Bulbs; Gums; Detergent solutions; Glass pieces.

Construction and Working

Procedures

i) Three villages Nathupur, Chandapur, Lakhmipur are taken.

ii) By constructions we can find out the point p which makes an angle 120^0 with the villages.

iii) The sum of the distances from this point to the villages will be the least as compared to the sum of the distance from any other points to the villages.

iv) To prove this experimentally three villages are connected

by three burettes such that each burette make an angle of 120^0 at petit point *p* with sides [I network].

v) Similarly taking another point inside the triangle and joining the village by burettes by considering that point as the origin.

vi) If we fill coloured water to the burettes in the I network and if we collect that water into a 100 ml beaker, then we will get the volume of the liquid filled.

vii) Similarly if we fill coloured water in the burette in the second network and collect this water into another 100 ml beaker, then we will get the volume of the liquid.

viii) If we measure the volume of the liquid in both the networks, then we can find that the volume of the liquid in the first network is less than that of the second network.

Volume = area x length

Since the dimensions of the burettes are same then the volume will differ by its length. Therefore, we can conclude that I network is the shortest.

ix) This idea can be extended to more than three points.

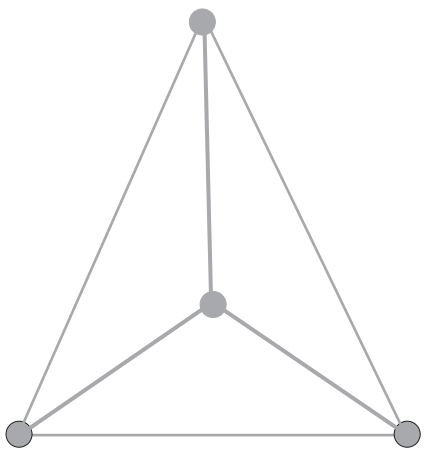

Fig. 1: I network in a triangle

Network Connecting Four Points

i) Consider four cities Srinagar, Delhi, Mumbai and Kolkata.

ii) We will obtain a quadrilateral if we join the four points.

iii) By construction we can find out two petit points.

iv) From this two points we can connect these four cities by the shortest network of road.

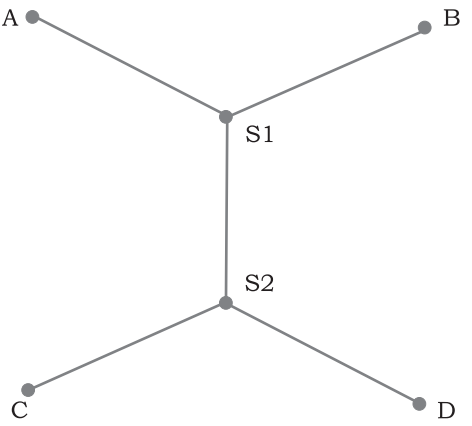

Fig.2: Four cities road network

How to Find Petit Points

Case 1: Earlier we have discussed that if we have 3 cities then we have one petit point which makes an angle of 120^0 with 3 cities.

Case 2: Now we have 4 cities. We will obtain a quadrilateral by joining the four points as shown in figure 3.

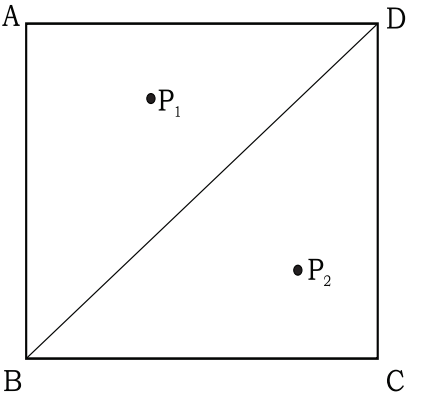

Fig. 3: Quadrilateral with two petit points

In quadrilateral ABCD we can draw a diagonal AC or BD to make two triangles. By case 1 we will get two (4-2) petit points.

Case 3: Now we consider 5 cities. When we join the five points we obtain a pentagon.

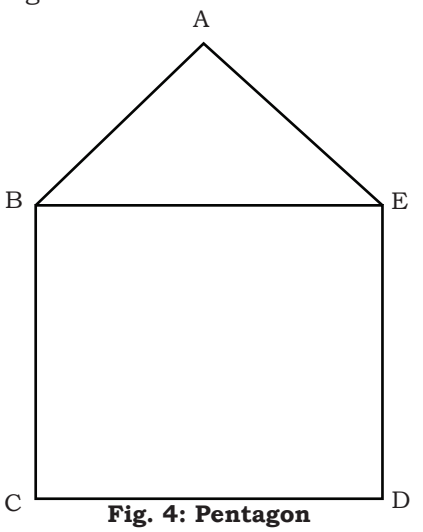

Fig. 4: Pentagon

Now join BE to make a triangle and a quadrilateral.

So by earlier cases 1 and 2, we get one petit point for triangle

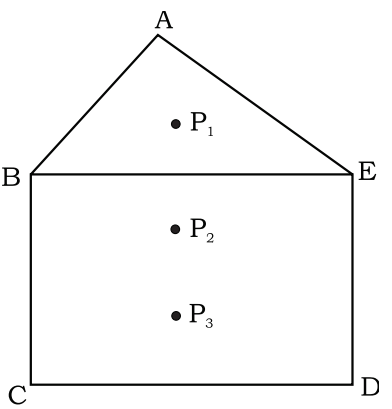

Fig. 5: Pentagon with three petit points

ABE and two petit points for quadrilateral BCDE. So we get three (5-2) petit points for pentagon.

In general, we can say that, if we have n number of points (cities) there will be (n-2) petit points.

This can also be experimented by soap film experiment, in which a polygonal shape is immersed in detergent solution, then due to the surface tension of the liquid they will try to occupy a

smaller area so they will follow a shorter path and this network will be similar to the network formed by connecting villages/ cities.

Using this model we can reduce the loss of power, energy and expenditure.

APPLICATIONS

i) To minimise the loss of water during irrigation.
ii) To connect gas pipeline of minimum length between cities.
iii) It is helpful for city planning.
iv) To plan the location of a railway station, bus stand in a city, so that it will be convenient for all the people of the city.
v) To save energy, time and expenditure.
vi) For the easy transportation of goods from one city to another.
vii) Pollution can be minimised.
viii) It will be comfortable and convenient for the people.
ix) It will help in conservation of electricity.

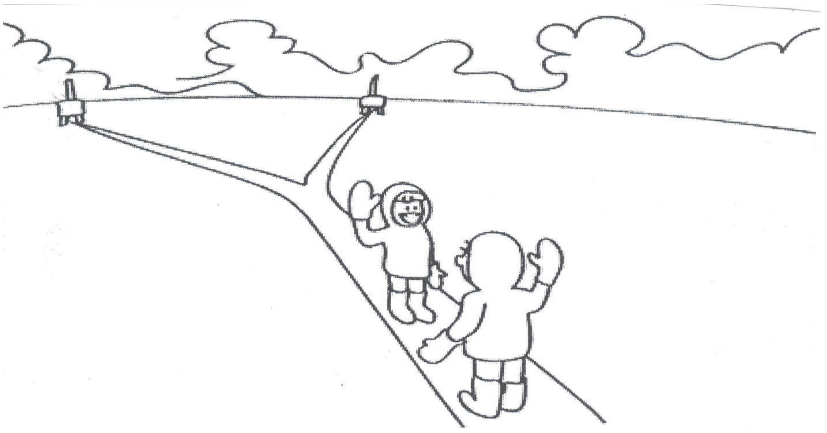

Fig. 6: Road network view

CONCLUSION

Our exhibit is a stride in the field of mathematics which brings science into the everyday life of man.

Through this model we tried to reduce the complexity of finding an optimum solution to the problems related with

distance and transportation. And moreover, it can be extended to plenty of problems related with linear programming and operational research.

References

i) Internet

ii) What is mathematics; Richard Courant and Herbert Robbins

11

Math In Bridge

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Introduction

People travel over bridges, millions of vehicles pass through the bridges everyday and in this process bridges bear tons of loads. What are the factors which make bridges so strong?

Why all over Delhi Metro Rail is suspended by the cylindrical pillars? Are the quality and quantity of concrete, cement and iron, the only responsible strong factor of the bridges and buildings? The model is an attempt to answer the above raised questions through some activities and construction of bridges by applying mathematical concepts. Life of the bridges and buildings not only depends on the quality and quantity of concrete, cement and iron but also on the mathematical concept used in the structural design of the building and bridges.

Mathematical Concepts

The exhibit is based on the combination of four mathematical concepts of triangle, circle, cylinder and proportionality. Following concepts are involved in the model making process:

i) Triangle is the strongest shape
ii) Roles of circles in bridges
iii) Uses of cylindrical shapes in structural designs of bridges
iv) Concept of proportionality is also involved in the model making process.

Degree of arc in arch bridge "d" can be calculated by measuring the length of the arch of the bridge and substituting the

value in

$$\frac{length\ of\ the\ arch}{2\pi r} = \frac{d}{360^{\circ}}$$

Where $\pi = 22/7$ or 3.14, $2\pi r =$ total circumference of the circle of which the arch of the bridge is one part.

Material Required

Empty water bottles; sand; steel wires; match boxes; ice cream stick; chart paper; A4 size paper and card board; rubber tubes; weights etc.

Construction

- Five types of bridges–Beam, truss, arch, cable-stayed and suspension bridges– are constructed as shown in figures 1-5.

Fig. 1: Cable-stayed bridge

Fig. 2: Truss bridge

Fig. 3: Suspension bridge

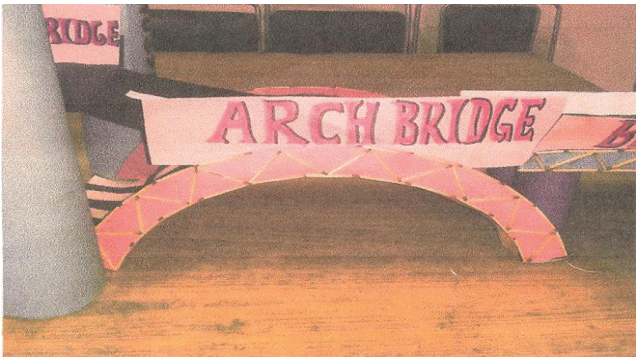

Fig. 4: Arch bridge

Fig. 5: Beam bridge

- Match sticks, cycle tubes, A4 size paper and card board weight are used for the performance of the activities related to triangle, circle and cylinder.
- Trusses are made with the help of fan-fold of chart paper and ice cream stick in truss bridge to show the load bearing capacity.
- Steel wires are used in the form of cable in the bridges.
- Water bottle filled with sand and steel wire act as cylindrical pillars with hollow centres.

ACTIVITY

(a) To measure the arch of a bridge in degree

We trace the arch of the bridge on a sheet of paper. We use the arch, which is now considered an arc of a circle, to complete the missing portion of the circle with the knowledge that a circle has 360^0. We measure the length of the arc that forms the arch of the bridges, and compare it with the length of the arch of the bridge to the circumference of the circle. This ratio should be considered equivalent to the ratio of the degrees in the arch of the bridge, which is unknown but could be called "d" to the total number of degrees in the full circle, 360^0. The two ratios are used as equivalent fractions to calculate the degree "s" of the arch of the bridge.

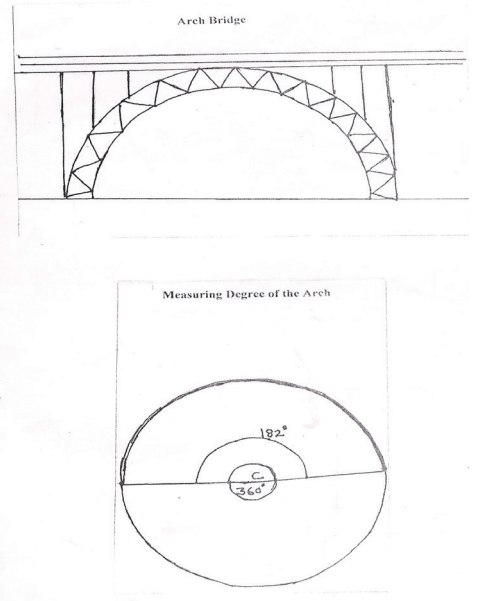

Fig. 6: The Arch of a bridge

(b) Triangular shape is strongest

We take the shapes like hexagon; pentagon; square and triangle made with help of match sticks and rubber tubes. We also need small weight of 20 to 25 grams and a hanger. We hang the same weight on every shape we mentioned above one by one and observe that every shape is deformed except triangular shape.

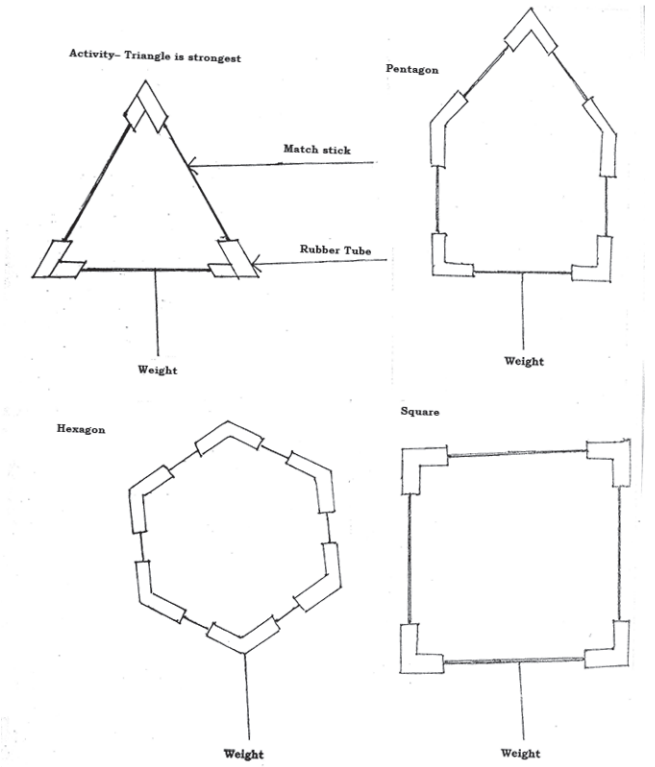

Fig. 7: Triangular shape is strongest

Triangle is able to bear the weight and its shape is intact. By this activity we come to the conclusion that triangular shape is the strongest. That is why triangular shapes are used in buildings and bridges.

(c) To show cylinders with hole at the centre are strong

In this activity we have prepared 8 to 10 cylinders of height 3 cm and radius 1 cm of each with the help of paper strips. Centers of

all the cylinders are hollow. Now erect these cylinders on a sheet of paper. Place a thin card board of A4 size on it and try to stand on it.

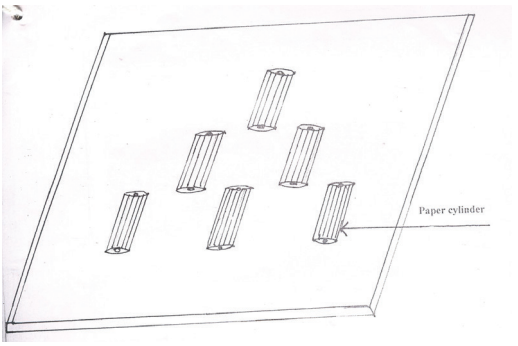

Fig. 8: Paper cylinder

We observe that small paper cylinders can carry your weight and their shapes are intact.

(d) Triangular fan fold is stronger than paper strip

Let us take four cylindrical pillars of paper of same size to provide support, small weight and a rectangular paper strip and fan-fold of about 6 to 8 inches. Place cylindrical pillars about 4 to 6 inches apart. Use the paper strip as a plank across the supports. Now place weight on the plank and observe. We notice that plank bends and weight falls. Now we put the fan-fold on the paper strip and again try to put same weight on it. This time weight does not fall. This is the evidence that fan-fold due to triangles has given the strength to the plank and it was able to bear the weight which paper plank could not.

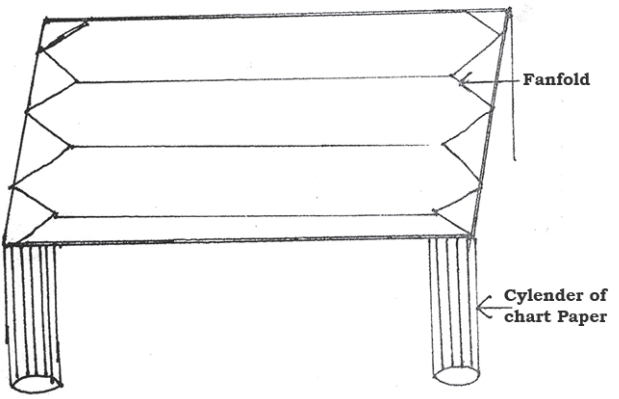

Fig. 9: Fan-fold activity

Advantages and Applications

i) Concepts can be used in making of buildings and bridges stronger and as a part of preventive measures in disaster-prone areas.
ii) Can be used in classroom activity for learning by doing.
iii) Example of real life mathematics.
iv) A good teaching aid to teach the concepts of triangles, cylinders, circles and proportionality.

References

i) Garrett's Bridges fun based learning
ii) www.vale.edu
iii) NCERT textbooks
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12

Innovative Plans for Village Development

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Introduction

There are many campaign running in our country to develop villages completely. Every M.P. and M.L.A. help the village development by adopting it. We have suggested five plans which are supplementary for village development. These plans are innovative, easy and cheap. It helps to control the problems of garbage, pollution and water. These plans will be a boon for "Clean India".

Scientific Principle Involved

- Production of earthworm from water using household wastes by simple method.
- Refill rain water of road by using innovative method.
- Innovative reuse of wastage papers thrown on road or burn.
- Pollution controlled innovative reuse of plastic garbage thrown on the road.

Material Required

i) Plastic bucket, ¾ inch diameter one feet long PVC pipe, sand, garbage of home, earthworms, stand, pots, water.
ii) Drawing board, blue metal (gitti), water.
iii) Two feet long tin drain, net of tin, sand, coal, soil, seed of sunflower, drainage water.
iv) Waste papers, small tub, moulds of various shapes and size.
v) Plastic garbage, one feet long air tight iron tank, one

feet rubber pipe, condensation tray, sand, small wooden moulds.

Construction and Working

a) Production of earthworm water

We took one feet height plastic bucket and made a hole in the centre of the bucket as shown in figure1. We made holes on ¾ inch and 1 feet long PVC pipe. We fixed this PVC pipe in that hole of bucket. A sand layer was made at the bottom of bucket and the bucket was filled using garbage of home except plastic, paper and glass. We poured water 3 or 4 times daily and in a day earthworms randomly come up and liquid released through their bodies. That liquid is mix with water in the bucket. The liquid mix water is collected in the lower pot through the

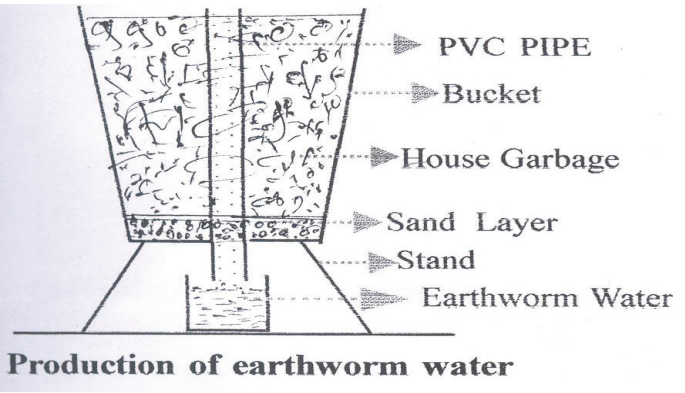

Fig. 1: Production of earthworm water

holes of PVC pipe. It called earthworm water. It contains the chemical Gibrelin. This earthworm water is very useful for orchard. This earthworm water cost around ₹ 500 per litre in the market. But here one can make earthworm water by management of household garbage at home itself. It helps to control the garbage thrown on roads and improve the quality of fruits of orchands.

b) Refill rain water of roads

Today we see everywhere, there is a drain of cement beside cement road. Because of it the rain water of roads flow through that drain. Hence water didn't soak and creates scarcity of water.

If we put one foot gap between cement road and cement drain and fill this gap by using blue metal (gitti). It helps

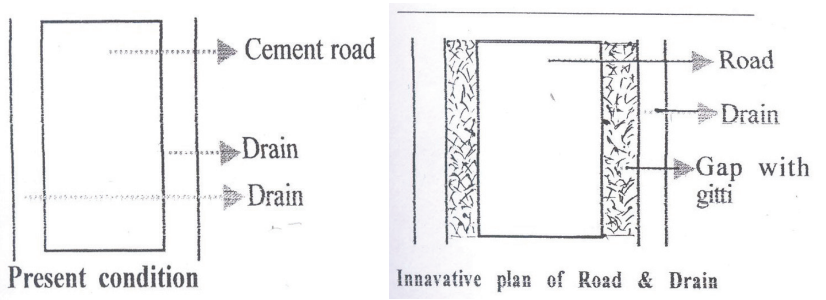

Fig. 2: Refill rain water of roads

to soak the rain water through this blue metal. The water will not flow through the drain. By this, the village will become prosperous with water.

c) Management of drainage water

Today we always see everywhere, drainage water release in the rivers through drain. It cause pollution of river water. To stop this water pollution, we filter the drainage

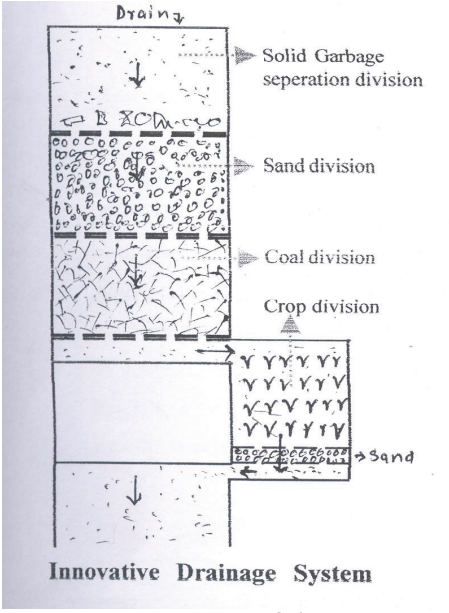

Fig. 3: Management of drainage water

water through four division. Firstly, we filter the solid garbage by fixing a net in the drain. Then we pass this drainage water through division of sand to filter deposit. Then we release this drainage water in coal division. It

absorbs micro-deposit and micro-organism from drainage water. Then this drainage water passes through the plants of Wal, Mohari and Sun-flower, which are planted on the bank of river. The roots of these plants absorbs some impure elements in the drainage water. In this way the filter water is released back in the river through the drain. Algae present in the river also has natural capacity to purify some quantity of impure water. In this way, one can easily manage the drainage water.

d) Management of papers from garbage

We soaked the papers garbage collected from school, offices and houses for 24 hours in the water. We stirred it and made pulp from this, which are then used for making paperboards, decorative items etc.

In this way, the management of papers from garbage is easily possible. By this one can open small scale industry easily.

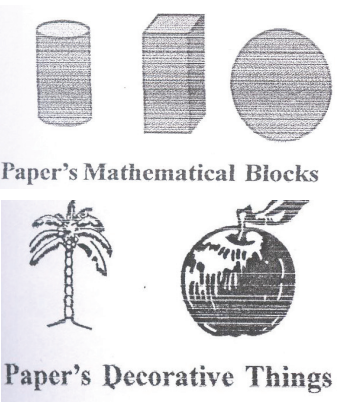

Fig. 4: Product from waste paper

e) Management of plastic from garbage

We made a simple machine for management of plastic garbage. The main part of this machine is air tight iron tank. We poured wastage plastic garbage, sand and *gitti*

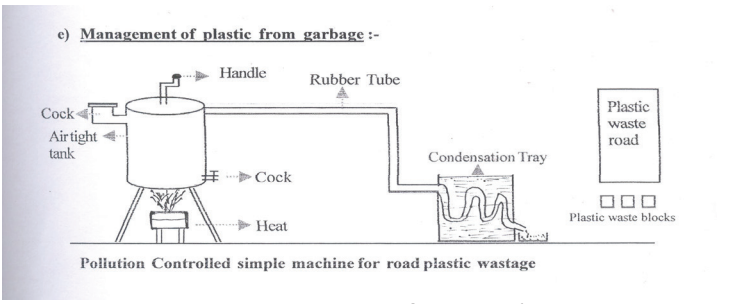

Fig. 5: Management of waste plastic

into the tank. The tank is heated and the vapour produce is sent to the condensation tray by rubber tube. The mixture left in the tank is collected and it can be used

to make small roads of village and small blocks. We can also use these blocks beside roads, in the garden and to decorate the square of villages and cities.

In this way,management of plastic garbage is possible.

Applications

- Smallscale industries can be established like the production of earthworm water, papers and boards, paper based decorative things, mathematical blocks, roads, blocks of plastic are build up in the villages using village garbage.
- Earthworm water is a boon to farmers and useful for orchards.
- Paper's mathematical blocks are very useful as a teaching aid.
- Plastic blocks are useful for roadside, gardens and to decorate square.
- By innovative drainage management, the production of crops like Wal, Mohari and Sunflower is possible. It helps to decrease water pollution of rivers.
- By building roads and drains innovatively in the village, it refill rain water in large scale.
- All plans are very easy, cheap and pollution controlled. So it should be implemented in every village and city.
- These plans help to control the problem of garbage, pollution and scarcity of water.
- This project is a boon for 'Clean India'.

Reference

I am regular reader of 'Marathi Vidnyan Partik' (Mumbai). This magazine help me in this project.

13

An Innovation in Construction

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Introduction

A geodesic dome is a spherical or partial spherical shell structure based on network of great circles on surface of a sphere.

The geodesic intersect to form triangular elements that have local triangular rigidity and also distributive stress across the structure.

When complete to form a sphere it is a geodesic sphere. A dome is enclosed unlike open geodesic structure such as playground climbers.

Triangles create self-bracing framework that gives structural strength using minimum materials.

Domes have natural integrity due to triangle shape in their construction.

Even though, there are many other structures which can be built but geodesic dome is a structure which is more stronger than any other structure in polyhedra and the model presented here shows the design of the dome in brief.

Scientific Principle Involved

The following scientific principles are involved:

i) When tension (force) is applied on top of the triangular shape, it is equally distributed on two other sides of the triangle. Resulted strain created by the forces is equally distributed on base of triangle, so area of contact increases and due to this the effect of pressure decreases.

ii) A triangle is composed of interlocked levers which allow

it to self-stabilise with a minimum of effort.

iii) When interconnected triangles are closed into a spherical shape, the resulting structure is stable.

iv) So the geodesic dome (sphere) created using triangles will more evenly distribute that force than any other polyhedral shape.

Material Required

An affordable alternative home option, geodomes are an eco-friendly answer to sustainable development. They are made of durable, competitively priced, high-quality architectural materials. To construct a geodesic dome we can use different materials like steel, wood, glass etc as per our requirements and other geographical conditions and circumstances.

To construct this demonstrative model we used the following materials:

Paper, Glue, Cardboard, Chart paper, Scissors, Thumb pins, Paper clips etc.

Construction and Working

To construct this geodesic dome we need to construct isosceles and equilateral traingles using struts of different lengths and lever to connect them. Suppose to construct a geodesic dome with diameter of 50 cm we need to construct 30 isosceles and 10 equilateral triangles.

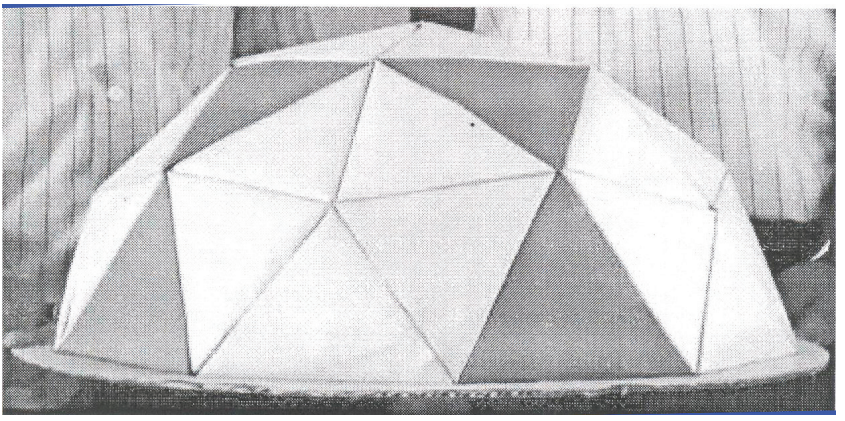

Fig. 1: Geodesic dome

Calculation for Working

Diameter for construction: 50 cm

Radius for construction, r = 25 cm
10 equilateral triangles with side A = 14.45 cm
30 isosceles triangles with side A = 14.45 cm, side B = 13.66 cm
For side A = r × 0.61803 = 25 × 0.61803 = 14.45 cm
For side B = r × 0.54653 = 25 × 0.54653 = 13.66 cm

ADVANTAGES

i) A dome is a geometric shape that encloses the largest amount of volume with the least amount of surface area. This generates a greater saving of building material to enclose usable space or work area than any other structure with a different form.

ii) Since their discovery, geodesic domes have been one of the safest havens in areas with the most extreme and violent climates on the planet, since exposure to cold in winter and heat in summer is reduced.

iii) The domes have an even distribution of weight on the ground plane through the bottom ring and a low centre of gravity, which gives it a great advantage over other structures when facing earthquakes.

iv) High winds generated by tornadoes, hurricanes and storms generate a negative air pressure when they hit the eaves and cornices of conventional home, capable of getting in underneath and totally or partially destroying roofs and leaving the occupants exposed. However, the aerodynamic shape of a geodesic dome and the absence of suction elements offer the best protection against the winds, whatever the direction.

v) Weeks, days and even hours can be the time taken to build a geodesic dome, depending on the complexity. There is also a possibility in some instances to disassemble and reassemble

Here are some historical examples

- Dome for the Ford Rotunda in Dearborn (Michigan), built in 1953. It has a span of 27.4 metres and was constructed in 5 weeks.
- Dome of the Honolulu Kaiser Auditorium, built in 1957. It has a 50 metre span, and it took 38 workers and 22 hours to erect it. An hour later, 2,000 people attended a concert of the Hawaii Symphony Orchestra.

vi) The geodesic shelter dome application can last up to 20 years with minimal maintenance. The net annual energy savings for a dome owner is 30% more than normal rectilinear homes.

14

ONTHOKPA LOO–FISH TRAP

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INTRODUCTION

Loo is an indigenous fishing implement of Manipur which is widely used to trap fishes in lakes, ponds rivers, drains and even in paddy fields where fresh and current water is in plenty. A traditional Loo has only one entrance called 'SHOU'. In manipur, most of the people engaged in agriculture are mainly accustomed to catch fishes. Such fishing practice can give more development in their economy and food security.

Since the traditional one has only one entrance which enables them to catch fish in small amount. Keeping this in mind, we have developed a model called 'ONTHOKPA LOO' having 7 (seven) entrances (SHOU) so as to enable to catch more fishes.

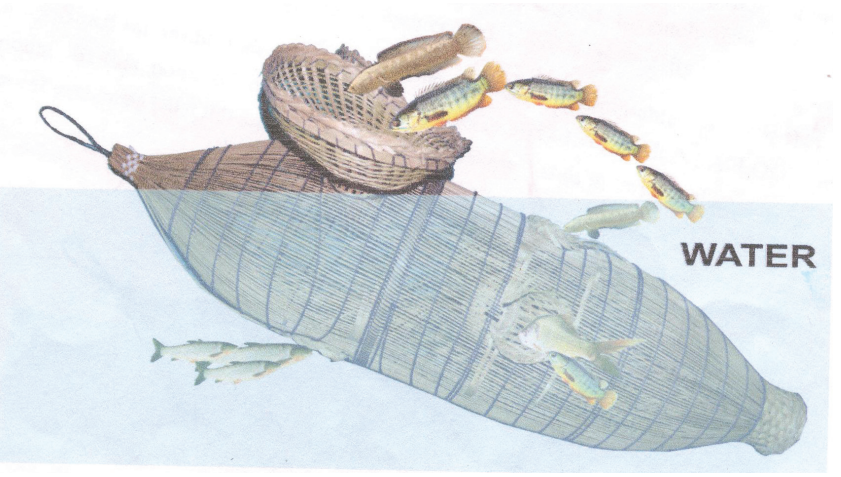

Fig. 1: Onthokpa Loo

Scientific Principle Involved

'ONTHOKPA LOO' is based on the scientific principle of Valve.

Material Required

Bamboo; Binding wire; Plastic etc.

Construction

'ONTHOKPA LOO' is an innovative fishing implement which is modified from that of traditional one. It is a right circular cylindrical shaped body having approximate dimensions of 34 inches height and 9 inches diameter with 7 (seven) entrances called 'SHOU'. The

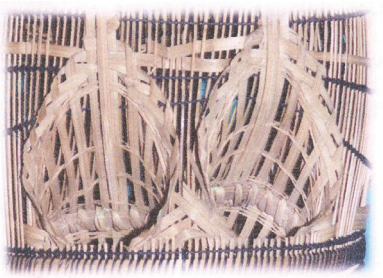

Fig. 2: Shou

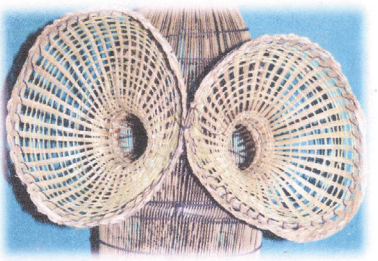

Fig. 3: Ngachong Shou

7 entrances are fixed on the lateral curve surface in different position. Among them, three SHOU (including NGACHONG SHOU) are fixed on the upper side, two SHOU on left and right side and the remaining two SHOU are fixed on the lower side.

Working

All the SHOU have different significant roles according to the different natural movement of fishes in water. Fishes like Lata fish (Ngamu), Puntius (Fabou-nga), Anabas (Ukabi) etc, having jumping and climbing tendency are enable to be caught by the NGACHONG SHOU. Fishes habituate towards the flow of water current and opposite towards the flow of water current are also enable to be caught by the remaining SHOU.

Advantages

i) It can trap different kinds of fishes simultaneously.
ii) Since it has 7 (seven) entrances (SHOU), it enables to catch more fishes rather than that of the traditional one.
iii) 'ONTHOKPA LOO' will enable to bring a point of economic solution.
iv) By using this Loo, one can save time, labour and money.

15

Removal of CO_2 from Atmosphere

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Introduction

With the increase in population of our country and for our desire of more comfort and shelter, the forest area of the country is decreasing due to cutting down of trees. The level of pollution and CO_2 is increasing in the atmosphere. The level of CO_2 was about 0.003% before some year but due to the deforestation, the level of CO_2 has increased up to 0.004%. If necessary steps are not taken we are going to face problems in coming days.

Scientific Principle Involved

The wet screen containing NaOH and polluted air containing CO_2 is converted into $Na_2Co_3H_2O$. Then by heating the $Na_2Co_3H_2O$ it is converted into NaOH and CO_2. The NaOH is again injected into the model and the CO_2 extracted are injected into very deep inside the earth to about 2000 metre.

Material Required

Wooden planks, Cotton blocks, Electric Motor, Pipe, 2 – Exhaust Fans, A.C & D.C Converter, Collecting Tank, 6 Pipette of Plastic, Aluminum sheet, Nails, M-Seal, Cello Tape, NaOH.

Construction

We have prepared the model by using wooden planks as shown in Figure 1. After that 6 cotton blocks are arranged at a

similar distance, which can absorb water. The exhaust fans are fixed at both the end of the model so that the outer polluted air can be entered as fast as possible and the air which is already present inside can be disposed of. Now NaOH is sprinkled on these cotton blocks.

For that we have to keep one motor at the base of the model so that it can easily allow NaOH to get entered inside the chamber. A collecting tank is kept at the bottom for collecting the solution.

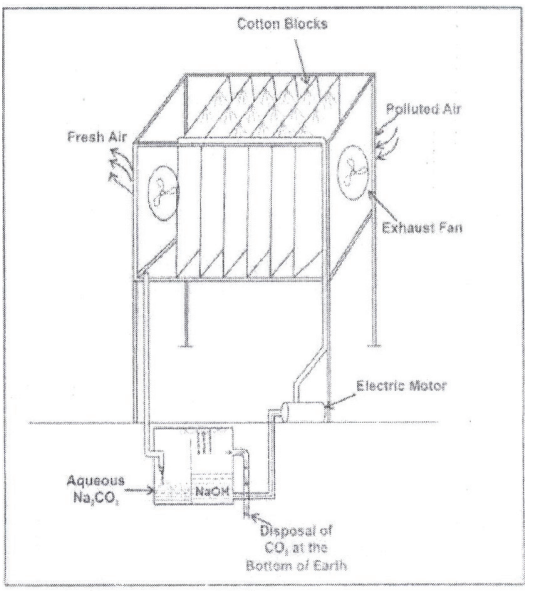

Fig. 1: Label diagram

WORKING

First of all the NaOH was sprinkled on cotton blocks, so that it soaks the NaOH properly.

Now, polluted air is made to enter in the model from the atmosphere by means of Exhaust Fan. This polluted air containing CO_2 while entering through the cotton block reacts with NaOH which is already present in cotton block and gives aqueous sodium carbonate ($Na_2CO_3H_2O$).

REACTION

$$2\ NaOH + CO_2 \longrightarrow Na_2CO_3H_2O$$

Fresh air is obtained from the other end of the exhaust fan. Now these aqueous solution of sodium carbonate ($Na_2CO_3H_2O$)

should be disposed of from the one end and it is collected in a collecting tank. These collected aqueous solution of sodium carbonate ($Na_2CO_3H_2O$) is provided with a required temperature at the bottom where the collecting tank is present and aqueous Na_2CO_3 will be converted into NaOH and CO_2.

REACTION

$$Na_2CO_3H_2O \xrightarrow{\triangle} 2\ NaOH(aq) + CO_2(g)$$

In this way we are taking CO_2 to the bottom of earth at around (2000 metres), so that this CO_2 will not again return back to the atmosphere. The remaining NaOH is recycled and sprinkle once again in the exhibit on its own.

ADVANTAGES

i) Excess CO_2 can be disposed of from our atmosphere.
ii) We can reduce the level of CO_2, from Express highway and from mostly traffic areas by using this model.
iii) Greenhouse effect can be reduced.

DISADVANTAGES

i) It is little costly as compared to other methods.
ii) For liberating CO_2 from aqueous sodium carbonate ($Na_2CO_3H_2O$), we have to provide temperature that is also very expensive.

16

CAP FOR THE VISUALLY IMPAIRED

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TEACHER
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INTRODUCTION

There are approximately 37 million blind people in the world, out of which 15 millions are in India. Most of them have no means to navigate other than existing products in the market which are exorbitantly priced (above 50,000 rupees). It is necessary to provide accessibility in terms of cost to all the visually impaired people in this world.

Braille is the most commonly used language in the world by the visually impaired, but in India and many other countries around the world, braille has not been established as a viable method of written communication. There are books available for the visually impaired but they do not come in reasonable variety. So, there is a need to make books available to the visually impaired people in a more cost effective way. Also, there are no products which aim to do so in a cost effective manner.

Our models tackle both these problems in a cost-effective way such that it is accessible to all in need.

SCIENTIFIC PRINCIPLE INVOLVED

The following scientific principles are involved:

- The principle SONAR using ultrasonic sensor and an Atmega 328 micro-controller. The ultrasonic sensor measures the time interval between a sound wave of frequency above 20,000 hertz. Then, it uses the speed of sound to calculate the distance between the ultrasonic sensor and the object. The formulae used for distance calculated as:

i) Speed = distance / time.
ii) Distance to the obstacle = time taken for receiver to receive the reflected ultrasonic wave × Speed of the ultrasonic wave.

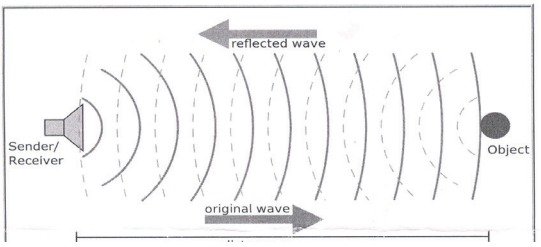

Fig. 1: Ultrasonic wave

- For the book readers we have used the principle of OCR (Optical Character Recognition), which converts an image containing text into simple text which is then read out for the visually impaired.

Material Required

- Atmega 328 chip is a micro controller chip which processes c++ codes and takes input from sensors and helps in calculating the distance resistors, capacitors, batteries cap, female headers, ultrasonic sensors, jumper wires, perf board.
- Raspberry Pi (Raspberry Pi is a 1000 rupees linux based computer), camera module, cardboard box.

Construction

While creating the navigator we mount two ultrasonic sensor on a cap at two different angles which is worn by the visually impaired person. This is because head movement is the most natural movement in a human. For example, if you hear a sound it's your head which turns towards it.

For the reading system, the camera is mounted on top of a cardboard box which is open from one side. From the opened side an A4 sized page is put inside a cardboard box for the raspberry pi to process the image taken.

WORKING

1. The Navigation System

- Two HC-SR04 ultrasonic sensors send the distances of an obstacle to the atmega 328 microcontroller chip.
- The chip then decides what frequency to play through the speakers:
- If the chip receives a reading from the sensor aimed at a low height, it means there is an object only at a low height and the chip plays a low tone indicating the height of the object.
- Else, if the chip receives a reading from the sensor aimed at a high height, it means there is an object at a higher height and the chip plays a high tone indicating the height of the object.
- Else, if the chip receives a reading from both the sensors, it plays low and high tones alternatingly.
- Else, if there is no reading from any of the sensors, it won't play a tone.

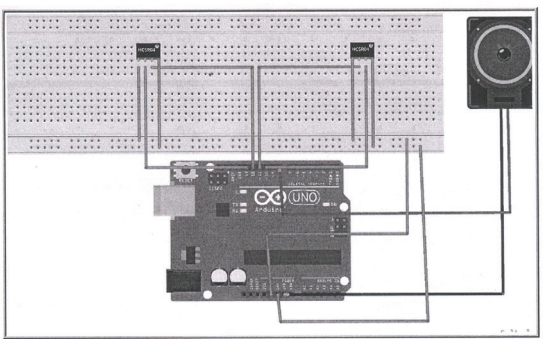

Fig. 2: Navigation System

2. The Reading System

- The reader for the blind basically reads out a normally printed page to the blind person. It uses the raspi camera (a raw camera) which takes a picture of a page inserted in the cardboard box.
- We use the open-source OCR software called Tesseract for processing the image. Using some image processing algorithms we change the alphabets found in the image to strings the programme can process.
- Then using the google text to speech software we convert the words into audio which the blind person can hear

using speakers or earphones.

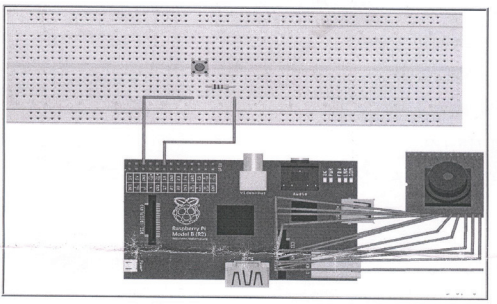

Fig.3: Reading System

Fig. 4: Cap for the navigation system

ADVANTAGES

i) Navigation System

- It replaces the traditional cane and leaves the hands of the person free.
- It is contact free. So, fragile objects can be sensed. Also, for example if the person is walking on the road, where there are stray dogs and if he/she hits one of them, then they may get agitated. Our model avoids this situation.
- Through extensive research we have found that existing electronic aids for the visually impaired are exorbitantly priced above 30,000 rupees. Our model, priced at 500 rupees, beats the existing aids by a large margin.
- Ultra Cane, a European company that produces canes equipped with ranging sensors to alert the user, prices its products at very high rates (around 70,000 rupees).

- Our model uses four 1.5 volt batteries instead of a 9 volt battery. This reduces loss of energy as heat.
- We use speakers instead of vibrating motors. This means that the battery life will be longer as motors are known to use more energy than speakers.

ii) Reading system

- In India there are very few braille teachers, hence braille is not accessible to the rural people.
- The current text to speech devices are very expensive and not accessible by the visually impaired who are financially poor.

References

- www.raspberrypi.org
- www.arduino.cc
- Beggining arduino (A book by Michael McRoberts)

17

Poisson Probability Distribution for Rhinoceros Conservation

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Introduction

Rhinoceros population in North East India is under threat because of adverse human activities. Their population is on constant decline because of the destruction of their natural habitat and rampant poaching. Deforestation and human intervention also caused a great damage to this animal population.

In this exhibit we have developed a physical and mathematical model to predict probability of finding number of Rhinos in certain square kilometre area in North East India.

Scientific Principle Involved

We applied the theory of Poisson distribution to this problem and started to predict the probability of finding number of Rhinos in certain square kilometre area in North East India.

Poisson distribution expresses the probability of a given number of events occurring in a fixed number of time or space. These events need to occur with a known average rate and independently of the time/ space since the last event.

$$P(x) = \frac{\lambda^x \times e^{-\lambda}}{x!}$$

Where
P(x) is the Poisson probability
λ is the mean value (here the mean number of Rhinos)
x is the variable (no. of Rhinos) of interest

Material Required

We made this model using old and discarded materials available at home like wooden plank (to make the base of the model), cardboard box (to house a motor which will rotate disc and will have the electrical connections and an electric switch), CD disc (with the Rhino geography mapped and small beads to represent Rhinos), Thermocol pieces (to make a tower for monitoring station), telescopic antenna (to provide a random axial movement) and a glass.

Construction and working

The model consists of a wooden base on which two modules are mounted. The first module has a cardboard box on which a motor is placed over which a disc is placed (so that it can be rotated by motor). The second module is placed to the right of the cardboard box which has a thermocol tower with a mounted telescopic antenna for providing a random axial variable.

i) We modelled the geography of interest on a disc on which we embedded beads to represent Rhinos.

ii) We randomised geographical space by rotating the disc on circular axis.

iii) We also introduced another random variable on radial axis.

iv) The monitoring station shows whether we find a Rhino or not in a given area

The process of modelling the geography on the disc is as follows:-

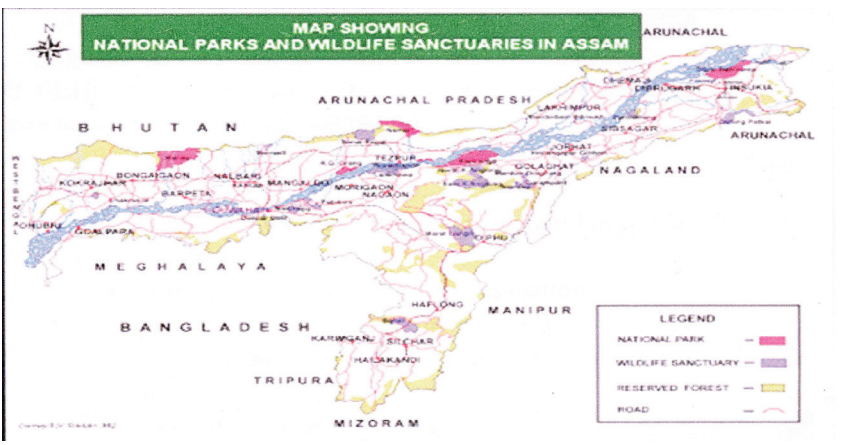

Fig. 1: Map showing National Parks and Wildlife Sanctuaries in Assam

Radius of Circular Disc = 6cm
Area of Circular Disc = πr^2=113.14cm^2
Area over which Rhinos are spread in Assam = 4365 km^2
No. of Rhinos in Assam = 3300 (approx)
113:4365 :: x : 3300
113/4365 = x/3300
We get x=85 (which is the number of beads which would represent the Rhinos on our disc).

Result and Calculations

λ =No. of Rhino/Area in sq.m
λ =(3300/4364930000)*100 (in metres)
λ = 0.007560259
Probability of finding a rhino in 100sq. m area
P = 0.00750331700319649

We found that the probability of finding the Rhino in random 100 sq. m area was very less and it follows Poisson trials (25 times in 1000 trials) and relates well with what we forecast using Poisson formula (0.00750331700319649).

Applications

i) Educational tool which can be used to gain knowledge can be applied to:
   - Analyse the clusters of Rhino population.
   - Study the movement of Rhino population.
   - Identify areas where urgent action need to be taken to save Rhinos from poachers.

ii) We approached WWF and offered our support to them on the conservation of Rhinos.

iii) To spread the awareness of habitat destruction and perils of poaching impacting this beautiful and strong animal

iv) This mathematical model can be applied to various wildlife conservation efforts.

v) To study the demography of tribal people and construct population maps.

vi) Gauge and map habitat destructions.

vii) We also made a simple android application to spread awareness. The application contains everything we need to know about the Rhinos in Assam from their binomial nomenclature to real time maps. This application also talks about the rate at which our Rhino population is decreasing.

viii) The cost of the model is less than Rs 500.00.

ix) Our model is homemade and made from waste material.

x) The Indian government and WWF can deploy resources on this basis and they can invest in areas where the probability of finding the Rhino is more and invest less in areas where probabiltiy of finding Rhino is less. This can save crores of rupees.

Reference

i) Statistics for Management, LEVIN Richard, RUBIN, David

18

WALKERATOR

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INTRODUCTION

Mobile is extensively used today by everyone whether he be a hawker, a labourer, a farmer, a commuter, a jogger or anybody else. When a mobile user is out of home, he often faces difficultly to find a source of electricity to charge the battery of his mobile when it discharges. In this exhibit, we have devised a device which can solve this problem. With this idea and aim we made a device which we named as WALKERATOR. It is tied to a person's leg while walking and connected to the mobile with a cable. It begins to charge the mobile battery as soon as the person begins to walk. It can charge a mobile anywhere, anytime without consuming additional energy and time.

SCIENTIFIC PRINCIPLE INVOLVED

The basic principle of generating electricity is involved in it. Electricity is generated by a dynamo or a turbine. The energy used in rotating the dynamo in this device is our physical energy. While walking, the angular motion of the knee rotates the dynamo without consuming much additional energy. The knee is a HINGE joint. The dynamo is fixed at the hinge of the device. The device is so tied to the leg that the hinge joint of the knee and the hinge joint of the device are aligned.

The hinge joint of the knee provides a large range of motion. The basic movements of this joint are Flexion and Extension.

- FLEXION- The movement that decreases the angle between the two bones at knee joint. At knee joint the flexion angle is about 70^{o}.
- EXTENSION- The movement that increases the angle

between the two bones. At knee joint the extension angle is about 110°.

- The difference between the two is 40°. This is the range of motion which is used to rotate the dynamo which in turn produces sufficient electricity to charge the mobile battery.
- Extension and flexion are the opposing motions.
- The voltage is stabilised by a zener diode so that the battery is not damaged.
- Gears are used to achieve maximum rotation in minimum angular displacement with the slightest motion of the knee.

Material Required

- Two metal scales.
- Metal sheet to make a box and lid.
- A small geared motor– as a dynamo.
- A rectifier– to maintain the direction of flow of current.
- A zener diode– to regulate voltage.
- Straps for fastening.

Construction and Working

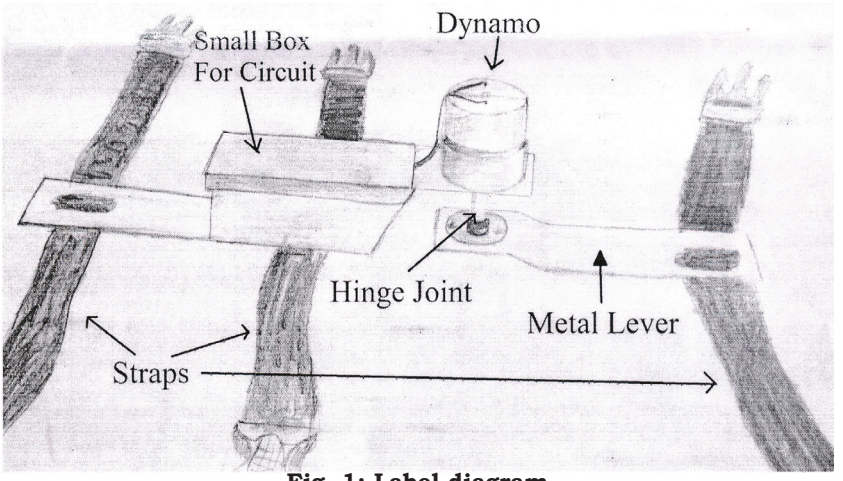

Fig. 1: Label diagram

A geared motor (dynamo) is fixed at the hinge of the two metal scales. A small box is fixed to the upper scale. It contains the circuit plate and a USB socket. Straps are attached to both the scale. The upper part of the device is tied to the thigh. The lower part is tied to the shin. The hinge joint of the device is

aligned with the knee joint. The output pins are soldered to the wire which goes inside the box making a circuit as shown in the figure 2.

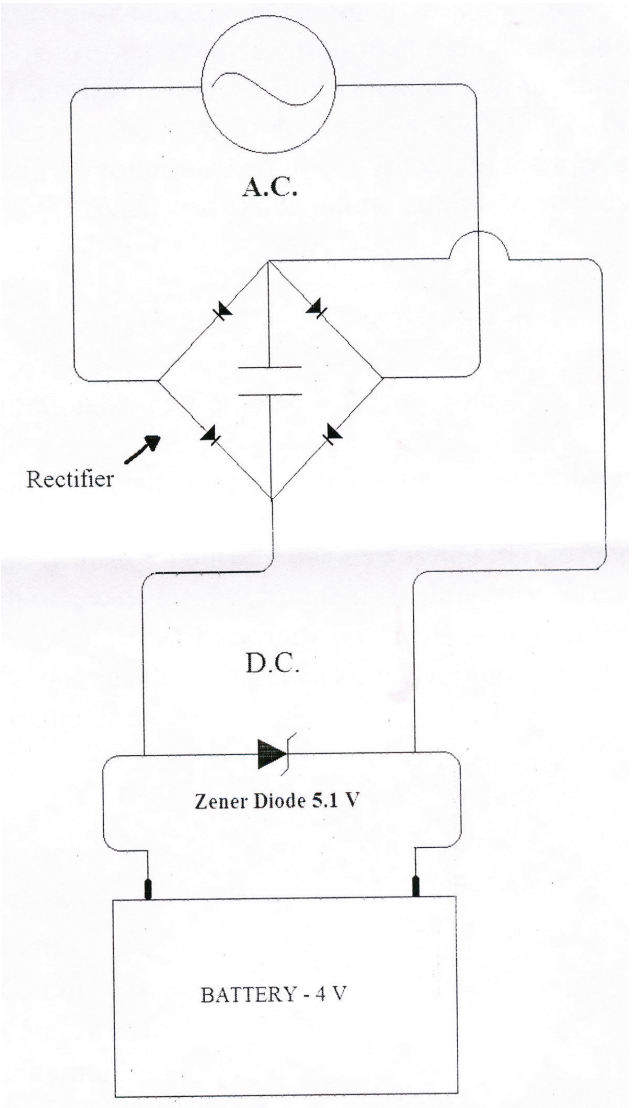

Fig. 2: Circuit diagram

When the wearer of the device walks, the change in the angular displacement due to flexion and extension rotates the axel of the gears. These gears increase the rotation of the dynamo about 100 times. Even the slightest change in the angle at the knee

rotates the dynamo rapidly.

When the axel of the gear makes one complete rotation (360°) the dynamo makes 100 rotations. But the range of motion at the knee is about 40 degrees.

Therefore when the movement of the leg changes from the extension to flexion, the dynamo makes → 40/360×100=11 rotations clockwise and again 11 rotations anticlockwise when the movement changes from the flexion to the extension. Thus in one complete step the dynamo rotates about 22 times.

Extension → Flexion → Extension

11 rotations + 11 rotations =22 rotations

Hence sufficient current is generated to charge the mobile battery.

Since the direction of flow of current changes twice in one step, a rectifier in the box ensures the flow of current in one direction only. A capacitor in the box ensures continuous flow of current. The USB switch at the wall of the box is used to connect the mobile through a cable. The mobile can be kept in the pocket. Thus hands remain free.

SPECIFICATIONS

- Length-36 cm
- Width – 4 cm
- Height- 7.5 cm
- Weight- 250 g
- Current Generates
- Potential differences– 5 volts

USES– It can be of great use to soldiers, hawkers, farmers, joggers etc. Common man can also make use of it when he is out of home. It is extremely useful to the rural people of our country as they generally face power cuts.

ADVANTAGES

i) Does not restrict the motion of the walkers.

ii) Light weight, does not put any strain on the walker's leg muscles.

iii) Durable.

iv) Comfortable for the walker, does not irritate any part of the knee, thigh or shank during its use.

v) Securely attachable to the leg.

vi) Easy for the walker to operate, simple mechanism, just tie it up and keep walking.

vii) No additional energy required.

viii) Even the least angular movement at the knee can produce current.
ix) Safe to use, no pinch points.
x) No additional time required.
xi) Can be used anywhere, anytime and by anyone.

Fig. 3: Walkerators

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वायरलैस उर्जा संचारण

विद्यार्थी

लोकेश शर्मा
मोहित सोनी

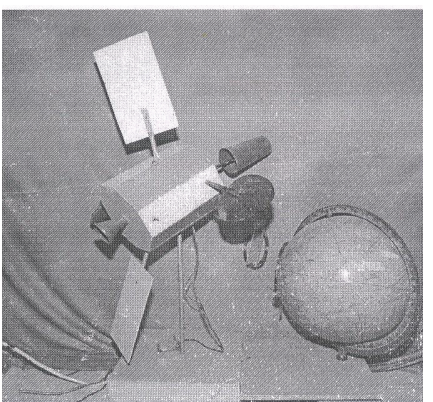
सेठ सम्पत रामजी दूगड़ उच्चतर माध्यमिक विद्यालय
सरदारशहर (चूरू), राजस्थान

अध्यापक

बजरंग लाल सोनी, मुकेश सोनी
और अभिलाषा सुथार

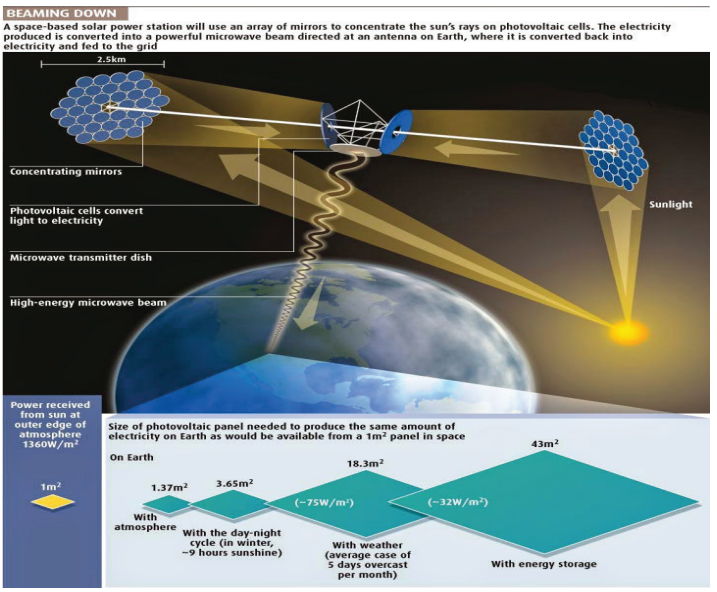
प्रस्तावना

हमारे अनेक कार्य विद्युत् के द्वारा संम्पन्न होते हैं। विद्युत् उत्पादन केन्द्रों से विद्युत् तांबे या एल्यूमिनियम के सुचालक तारों द्वारा ट्रांसफार्मारों से होते हुए हमारे घरों तक पहुँचती है। विद्युत् बनने से लेकर घरों तक पहुँचाने में तारों के कारण विद्युत् में ह्रास हो जाता है क्योंकि तार में विद्युत् प्रवाह में कुछ प्रतिरोध होता है। यदि इस प्रतिरोध के कारण हुई कटौती को कम कर दिया जाए तो विद्युत् उत्पादकता को बढ़ाया जा सकता है।



चित्र 1

पृथ्वी पर हम सौर ऊर्जा से विद्युत् लगातार प्राप्त नहीं कर सकते परंतु कृत्रिम उपग्रह पर लगे सोलर पैनलों को चौबीसों घण्टे प्रकाश मिलता है। यदि इसी तरह अंतरिक्ष में लगे सोलर पैनलों द्वारा विद्युत् उत्पादन कर उसे माइक्रोवेव में बदल कर पृथ्वी पर टी.वी. प्रोग्राम की तरह प्राप्त करें तो हमें सूर्य प्रकाश से 24 घण्टे विद्युत् प्राप्त हो सकती है।



चित्र 2

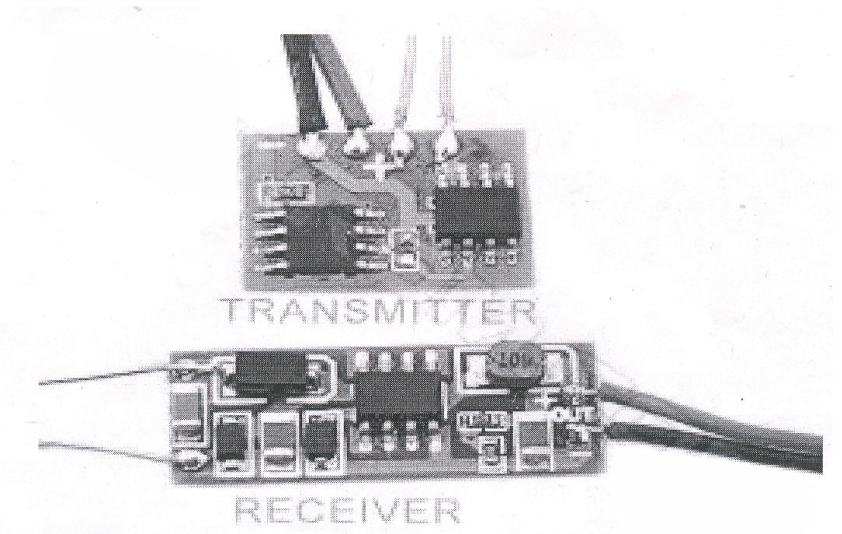
इसी परिकलप्ना के आधार पर यह प्रदर्श तैयार किया गया है। सेटेलाइट पर लगे सोलर पैनलों से प्राप्त विद्युत् को सामान्य इन्डकशन धारा में बदल कर बिना तारों के कुछ दूरी (पृथ्वी) पर प्राप्त किया गया है। इन इन्डकशन धाराओं को विद्युत् परिपथ की सहायता से पुन: डी. सी. विद्युत् धारा में बदला गया है तथा एल.ई.डी. से प्रकाश प्राप्त किया गया है। इस प्रक्रिया में बिना तारों के विद्युत् एक स्थान से दूसरे स्थान पर भेजने की कल्पना को साकार किया गया है। इसके द्वितीय भाग में हम इसी अवधारणा से मोबाइल बैटरी चार्ज कर सकते हैं। यह भी प्रायोगिक रूप से इस कार्यकारी प्रदर्श में दिखाया गया है।

नासा में अमेरिका के वैज्ञानिकों ने इससे संबंध में सोचते हुए प्रारंभिक रूप में कई प्रयोग किए इस क्षेत्र में सबसे पहला प्रयोग टेसला नामक वैज्ञानिक ने किया जिसे "टेसलाक्वायल" नाम दिया गया। इस प्रयोग से विद्युत् का प्रवाह बिना तार के करवाया गया। अभी भी इस संबंध में कई प्रयोग हो रहें हैं।

इस प्रदर्श में विद्युत् धारा को ए.सी. से डी.सी. में रूपान्तिरित करने का सिद्धांत, डी.सी.धारा की आवृत्ति को पुन: उच्च आवृत्ति में बदलने का सिद्धांत, टेसलाक्वायल का सिद्धांत और प्रेरण के सिद्धांत का उपयोग किया गया है।

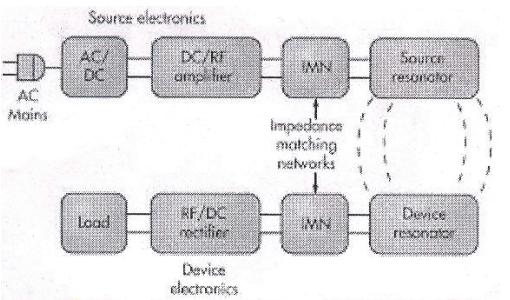
सामग्री

कुछ सुचालक तार, इलेक्ट्रोनिक परिपथ के लिए आई.सी., संघनित्र (condenser), प्रतिरोध, ट्रांसफॉर्मर, लकड़ी का पट्टा इन्सुलेटर तार, रंग रोगन आदि।



चित्र 3

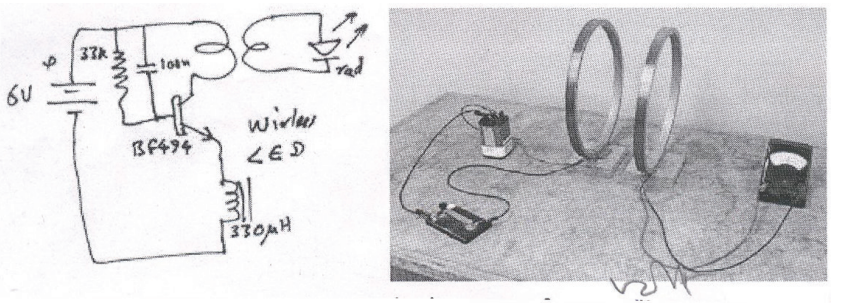
कार्यप्रणाली



चित्र 4

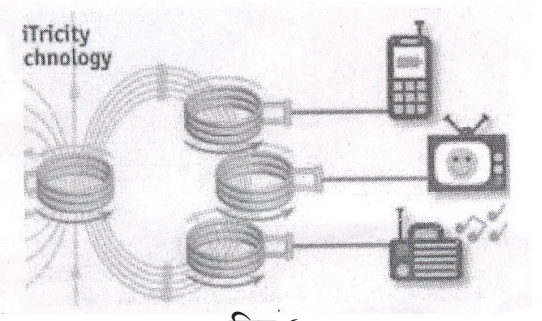
सेटेलाइट पर लगे सोलर पैनल से प्राप्त विद्युत् को सामान्य इन्डकशन धारा में बदलकर बिना तारों के कुछ दूरी पर ग्रहण किया गया है। इन इन्डकशन धाराओं को विद्युत् परिपथ की सहायता से पुन: डी.सी. विद्युत् धारा में बदला गया है तथा एल.ई.डी. से प्रकाश प्राप्त किया गया है। इस प्रक्रिया में बिना तारों के विद्युत् एक स्थान से दूसरे स्थान भेजने की कलपना को साकार किया गया है। इसके द्वितीय भाग में हम इसी अवधारणा से मोबाइल बैटरी चार्ज कर सकते हैं। यह भी प्रायोगिक रूप

से कार्यकारी मॉडल के रूप में दिखाया गया है।



चित्र 5

सर्वप्रथम घरों से प्राप्त ए.सी. 220 Volt धारा को रेक्टीफायर (डायोड) की सहायता से डी.सी. में बदल गया। अब 12 Volt डी.सी. को उच्च आवृत्ति के ऑसिलेटर सर्किट में भेज कर इसे 6000 Volt ए.सी. में बदल कर टेस्लाक्वायल परिपथ की प्राइमरी क्वायल में भेजा गया उच्च आवृत्ति के साथ इस प्राइमरी क्वायल के जुड़ी सेकण्डरी क्वायल में प्रेरणा के सिद्धांत पर 15000 Volt में बदल गया। यह 15000 Volt जो उच्च आवृत्ति की इलेक्ट्रोमैगनेटिक रेडियो तरंगो में बदल जाती है इन तरंगो के क्षेत्र में आने वाली हर सुचालक वस्तु में पुन: विद्युतीय बल की उत्पत्ति हो जाती हैं और इस क्षेत्र में क्वायल के साथ जुड़े बल्व एल.ई.डी. या ट्यूब लाईट, सी.एफ.एल. आदि प्रकाशित हो जाते हैं।



चित्र 6

Note

Note

विद्यया ऽमृतमश्नुते

एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING