A PROJECT REPORT

ON

"Solar Powered RC Car"

Submitted by

MANSOORI MOHD OSAMA IQBAL (17ME57)

SHAIKH MUBEEN ABDUL MAJID (14ME50)

KHAN SALMAN JAMALUDDIN (18DME37)

KHAN NAGMA (18DME20)

SHAIKH ZAID (12ME73)

In partial fulfillment for the award of the Degree

Of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

UNDER THE GUIDANCE

Of

Prof. JALAL KHAN

DEPARTMENT OF MECHANICAL ENGINEERING

ANJUMAN-I-ISLAM

KALSEKAR TECHNICAL CAMPUS NEW PANVEL,

NAVI MUMBAI – 410206

UNIVERSITY OF MUMBAI

ACADEMIC YEAR 2020-2021

ANJUMAN-I-ISLAM

KALSEKAR TECHNICAL CAMPUS NEW PANVEL

(Approved by AICTE, recg. By Maharashtra Govt. DTE,

Affiliated to Mumbai University)

PLOT #2&3, SECTOR 16, NEAR THANA NAKA, KHANDAGAON, NEW PANVEL,NAVI MUMBAI-410206, Tel.: +91 22 27481247/48 * Website: www.aiktc.org

CERTIFICATE

This is to certify that the project entitled

"Solar Powered RC Car"

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SHAIKH MUBEEN ABDUL MAJID

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SHAIKH ZAID

To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by **University Of Mumbai**, is approved.

Internal Examiner	**External Examiner**
(Prof._____)	(Prof._____)
Head of Department	**Principal**
(Prof. Zakir Ansari)	(Prof. Abdul Razzak Honutagi)

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APPROVAL OF DISSERTATION

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(Internal Examiner) **(External Examiner)**

Date: _____

ACKNOWLEDGMENT

I would like to take the opportunity to express my sincere thanks to my guide **Prof. Jalal Khan**, Assistant Professor, Department of Mechanical Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout our project research work. Without his kind guidance & support this was not possible.

I am grateful to him for his timely feedback which helped me track and schedule the process effectively. His time, ideas and encouragement that he gave is help me to complete our project efficiently.

I would like to express deepest appreciation towards DR. ABDUL RAZAK HONNUTAGI, Director, AIKTC, Navi Mumbai, Prof. ZAKIR ANSARI, Head of Department of Mechanical Engineering and Prof. RIZWAN SHAIKH, Project Coordinator whose invaluable guidance supported us in completing this project.

At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped me directly or indirectly during this course of work.

Mansoori Mohd Osama Iqbal
Shaikh Mubeen Abdul Majid
Khan Salman Jamaluddin
Khan Nagma
Shaikh Zaid

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included. I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Student Name: _____

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Abstract

Solar energy is a renewable energy which would exist for even billions of years more. In 2015, COP21 known as the 2015 Paris Climate Conference took place in Paris and the cooperation of over 190 countries agreed on climate, with the aim of keeping global warming below 2°C. In this conference many conditions were imparted on developing nation like India to reduce carbon monoxide emission, which ultimately affect the transportation by road and their development. Thus, the use of renewable energy like solar has to be incorporated in transportation in order to reduce the carbon monoxide emission without any lag in development. This is a review paper dealing with research paper published related to solar electric car. The idea of this project is to design a solar car that aims to tackle the problems related to pollution and shortage of fuel. A Smart vehicle is the one that takes all our burdens on maintenance of the vehicle while ensuring safety and comfort for the driver and the passengers. Various parameters have to be taken into account while designing such a vehicle. In our design we have divided the whole system into two major divisions namely, Vehicle monitoring system. Safety system Vehicle monitoring system includes IR sensors that sense the obstacle in front of it. This also includes sensing objects in the proximity of the vehicle which helps in parking and driving in heavy traffic. The flexible solar panel is used to generate power and keep it light weight.

1. Introduction

This chapter will explain the study that is related to the project task. Besides that, this chapter will be important references, journal and the important information about the project. The information got from several sources such as websites, journals, books, magazines, handout and others.

1.1 IMPORTANCE OF RENEWABLE ENERGY

Delhi, capital city of India is one of the most heavily polluted cities in India as per the Figure 1. Recent study shows that pollution due to road dust and vehicles account for about 50% of total pollution. Number of solution was proposed which mainly includes afforestation and restriction on usage of the vehicles. Fine particulate matter (PM2.5) is an air pollutant that is a concern for people's health when levels in air are high.

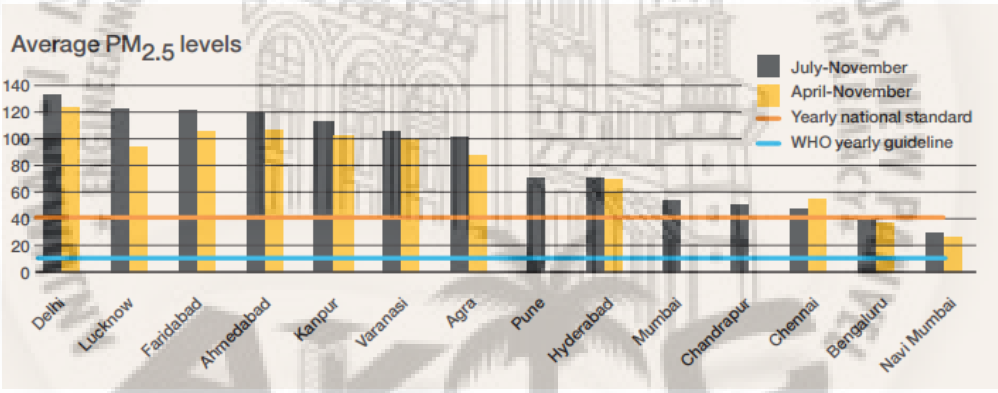

Figure 1 Pollution level

- Air pollution in Japan, China, and Germany forced government to adopt aggressive recycling and thus solar power in Japan has been on the rise since 1990s.
- Now Japan is the leading manufacturer of photovoltaic and it is also has the third largest solar PV installed capacity behind China and Germany.
- Moreover, Japan opts for making solar power an important national project since the county's shift in policies towards renewable after Fukushima in 2011.
- As per the pie chart in Figure-1.1.2 about 22% of total pollution in Beijing is due to Vehicles.

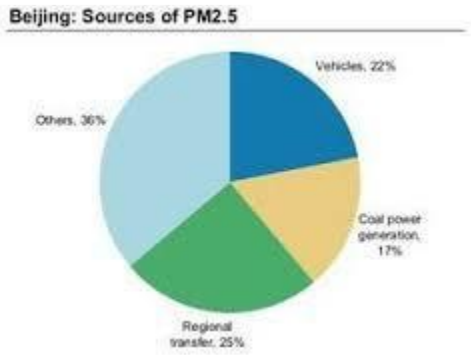

Figure 2 Pie chart

1.2 SOLAR POWER

Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power. Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect.

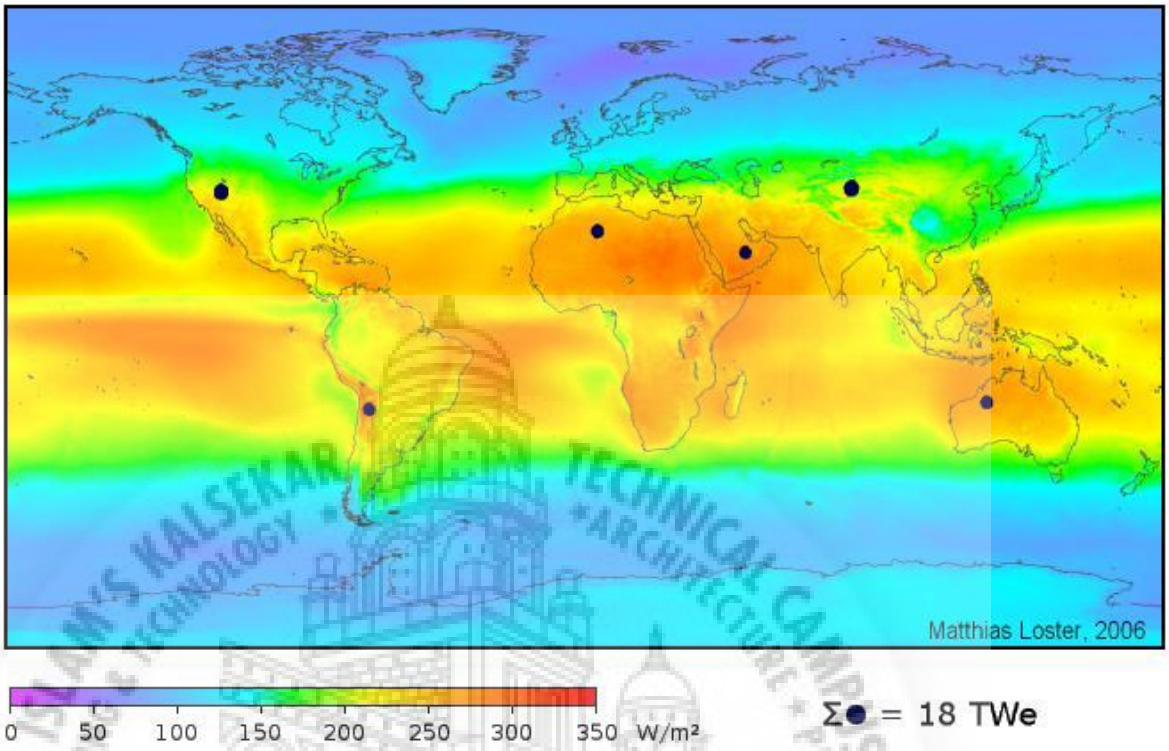

Figure 3 Map showing the Solar Energy Distribution across the Globe

The International Energy Agency projected in 2014 that under its "high renewables" scenario, by 2050, solar photovoltaics and concentrated solar power would contribute about 16 and 11 percent, respectively, of the worldwide electricity consumption, and solar would be the world's largest source of electricity. Most solar installations would be in China and India. The above Figure - 1.2 represents the solar energy distribution across the globe.

Photovoltaics were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system. As the cost of solar electricity has fallen, the number of grid-connected solar PV systems has grown into the millions and utility-scale solar power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun. The current largest photovoltaic power station in the world is the 850 MW Longyangxia Dam Solar Park, in Qinghai, China.

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1.3 SOLAR POWERED CAR

A car powered by solar energy is a vehicle that uses a type of renewable resource that can be obtained when sunlight incident on the solar panel placed on the surface of the vehicle. To keep the car running smoothly, the driver must monitor multiple gauges to spot possible problems. Cars without gauges almost always feature wireless telemetry, which allows the driver's team to monitor the car's energy consumption, solar energy capture and other parameters and thereby freeing the driver to concentrate on driving.

Solar cars combine technology typical aerospace, bicycle, alternative energy and automotive industries. The design of a solar vehicle is severely limited by the amount of energy input into the car. Most solar cars have been built for the purpose of solar car races. Some solar cars are designed also for public use.

Solar cars depend on a solar array that uses photovoltaic cells (PV cells) to convert sunlight into electricity. Unlike solar thermal energy which converts solar energy to heat for either household purposes, industrial purposes or to be converted to electricity, PV cells directly convert sunlight into electricity. When sunlight (photons) strike PV cells, they excite electrons and allow them to flow, creating an electric current. PV cells are made of semiconductor materials such as silicon and alloys of indium, gallium and nitrogen. Crystalline silicon is the most common material used and has an efficiency rate of 15-20%. The first solar family car was built in 2013.

1.4 Aim

The aim of the "Autonomous Solar Electric Vehicle" project is the investigation and realization of a reduced scale autonomous solar electrical vehicle. The project covers many different engineering disciplines including automatic control, power electronics, electric drives, mechatronics, telecommunication and embedded computation. We provide a platform to learn and gain experience in the fields of control, power electronics and embedded computation and allows researchers to investigate, implement and validate advanced control concepts related to electric vehicles.

2. Literature Survey

2.1 Research paper

Abhinya Chaturvedi, Kirti Kushwaha, Parul Kashyap, Dr. J. P. Navani of

Electrical & Electronics Department, Raj Kumar Goel Institute of Technology for Women, Ghaziabad, India presented a paper on April 2015 about solar powered vechicle. This survey aims at reducing fuel cost and to use hybrid technologies including the possibilities of hydrogen fuel.The paper also explains about the history of solar vehicles and development of a telemetry system where solar power cars can serve for better understanding of energy usage in vehicles and the aspects applicable to electric vehicle as a whole.

The review work is the study of all previous works related to the electric and solar cars have been done. Solar powered vehicle is a three-wheel drive and has been used for shorter distances. The main concentration was made on improving the design and making them cost effective. Energy from Sun is captured by the solar panels and is converted to electrical energy. The electrical energy thus obtained is being fed to the batteries that get charged and is used to run 24 V DC high torques DC series motor. The shaft of the motor is connected to the rear wheel of the vehicle through chain sprocket. The batteries are initially fully charged and thereafter they are charged by panels.

After giving an overview of the cars which are already in use, here is a detailed description of our solar powered vehicle. It is a four wheeler, two seater vehicle. In this vehicle we have used a belt pulley mechanism. The solar energy is harnessed using solar panels which are used for charging the batteries. The batteries run the motor which drives the wheel of the vehicle. The vehicle which we have made as our project uses a belt pulley mechanism in which the shaft of the motor is connected through the belt pulley system. The power supplied to the batteries is from the solar panels which are giving a total output of 4ooW and they are then used for charging the batteries. The batteries which we are using are lead acid batteries which are of 48V rating each of 12V. The motor's rating is of 48V which gets charged through the four 12V batteries. The belt used in our project is a timing belt which has teeth that fit into a matching toothed pulley. When correctly tensioned, they have no slippage, run at constant speed, and are often used to transfer direct motion for indexing or timing purposes. They are often used in lieu of chains or gears, so there is less noise and a lubrication bath is not necessary. Timing belts

need the least tension of all belts, and are among the most efficient. We have laid emphasis on the economical part so that it can be used to cover short distances without consuming energy from external sources and at the same time keep the environment pollution free.

Xiujuan, et al [1] explained the advantage of electric vehicle is that the electric vehicle has zero discharge, low noise and wide source for energy supplement the transformation efficiency of the photovoltaic cell plate is very low (i.e.) 14% because of strong maneuverability the working environment of the solar car changes frequently algorithm of max power point tracking should be increased to get high transformation efficiency condition At present, the common maximum power point tracking methods are the constant voltages tracking method, the perturbation and observation control and the conductance increment method. The tracking accuracy of the conductance increment method is the best among them. It achieves the tracking of the maximum power point. It is obvious that the output power varying different area when we change the working voltage in the area of constant current source the sensitivity is low and in constant voltage load the sensitivity is obvious so the tracking method should be improved In order to improve the accuracy of the maximum power point tracking, when the temperature and the light intensity are definite, and the output power of the photovoltaic cell is close to the maximum power which is the most at the current condition same extent, the tracking step length will be properly lessened , in order that the maximum power point can be tracked more accurately

Rattankumar, V, and N. P. Gopinath[2] Keeping the fact that there is no future fossil fuel we had think of using non conventional energy in effective manner. we have overcome many disadvantage of normal car such as minimizing Coupling losses, BLDC minimizes field losses, smooth handling of speed and fuel cost is minimized .The major parts used while manufacturing a solar car are Photovoltaic module, Solar tubular batteries, BLDC, Ackerman steering, Mechanical structure and MCB .Some of the accessories of solar car are Ackerman steering, Mechanical structure, Miniature Circuit Breaker**.** At present, the designed solar car runs at a speed of 30Km/Hr for one charging which takes approximately 18 hours and successfully tested for 100Km per charge. Further work is in process to develop the vehicle with Reluctance motor as now it is run by BLDC. It is also proposes to use solar panels of higher efficiency with minimal size. Various drawbacks of the vehicles are studied and steps are in process to eliminate them, hoping that a successful commercial model of solar car will be developed in the future.

Alnunu, Nasser, et al.[3] Since the awareness about sustainability, environment and limitation of conventional sources of energy are being getting supported Research and development in the area of renewable energy is growing fast. Realizing the potential of renewable energy by oil and gas companies and have been supporting the developing technologies and expertise for this field. Shell is one of these car races have started in the mid-80s, and have been very successful ever since. Races such as the World Solar Challenge, the Shell Eco-marathon, the North American Solar Challenge, the South African Solar Challenge and the World Solar Rally are now well established and attract participation of university student teams from all over the world SHELL ECO-MARATHON RACE. Annually in three continents: Americas, Europe and Asia the shell eco- marathon race are held. There are two categories of participation: prototype and urban concept cars. There are number of subcategories under each category on the energy basis. Prototype participant must complete eight laps and a total distance of 25.485 km and a maximum time of 51min. Each team is limited to four official attempts, and the best result is retained. The track is reasonably safety and technical tests to be allowed to race. There are some generic principles for designing and modeling solar cars. Typically, the design is of two main phases, namely, mechanical and electrical. Technical as well as soft skills of the engineering student can be improved by solar car races. The experience of QU students' first participation in Shell Eco-marathon race, and has paved the way for future regular participations. The team managed to design from scratch, locally-manufacture and test a solar car in the space of just few months. This car met all the technical and safety inspections tests and participated in the race along with hundreds of entries from all over the world; the goal is achieved. The next participation will be in Shell Eco-marathon Asia in Malaysia 2012, and the team aims to be in the top ten of their category. Work is already under way to design generation 2 of the car.

Qian, Jia, and Song Jie.[4] Because of zero pollution there is the development of "future car" called solar car . In solar car there is no engine, gear box and other component. It is composed of battery board, storage appliances and motor. Aerodynamic drag will be the largest driving resistance replacing the other resistance for the normal car when its speed is more than 60-70 km/h. For the small power solar car, body design with less aerodynamic drag coefficient will be the focus Traditional method of automotive aerodynamics study is wind tunnel testing which requires higher quality facilities, longer research cycle and higher funds. With the development of computer technology, computational fluid dynamics (CFD) method in the automotive

aerodynamic research is increasingly important. CFD method has a short cycle, low cost, no real vehicle models and other characteristics. Build geometry of the flow area, border type, and mesh generation using pre-processing software GAMBIT and output the format for the FLUENT solver two kinds of discrete format of first-order upwind and second-order upwind, first first-order upwind is used, after a certain number of iterations, second-order upwind scheme is used to improve the accuracy and convergence of the calculation and to reduce the computation time but it is difficult to converge final alteration therefore it is made by first-order upwind scheme. The resulting aerodynamic drag coefficient and the aerodynamic lift coefficient are relatively small.

Yesil, Engin, et al.[5] The employment of Big Bang – Big Crunch optimization method in World Solar Challenge is proposed in 2013. Renewable energy resources it is important to optimally utilize them in an efficient way Istanbul Technical University (ITU) Solar Car Team was founded in 2004 not only to practically design solar powered cars, but also to demonstrate how efficient an electric car could be and to promote the importance of clean energy. In order for a solar team to come in first place, solar car motor with a durable structural design and realistic estimation the optimization task. Low speed profile in case of cloudy weather, high in case of sunny conditions High speed profile in case of cloudy weather, low in case of sunny conditions, Constant speed throughout the race. The aim of the study is to determine an optimal strategy to minimize the race duration while supplying the race regulations and the constraints imposed by the environmental conditions.

Vincent, Vineeth V., and S. Kamalakkannan[6] A three-input hybrid system for solar car is designed . the are two storage element, one unidirectional input power port and two bidirectional power ports .Three different power operation modes are defied for the converter, Depending on utilization state of the battery. Battery charging in the system is carried out from the amorphous solar panel mounted on the body. The efficiency of the system will improve since the solar energy is directly given to the DC load. The capacitor which is connected to the lead acid battery will charge at off peak hours and discharge during the acceleration time of the car. In this proposed system energy wasted in the brakes are also recovered and used to charge the lead acid battery. Hence competent Hybrid Electric Vehicle was developed by using super

capacitor and regenerative braking scheme. The simulation results of the proposed systems show that the performance of the vehicle was improved by providing better working conditions for the battery and increase its operating

life, Source of energy extended up to the, regenerative braking scheme along with solar source, will increase the system reliability. Since the super capacitors have the ability to provide a large current in short time acceleration, performance of the vehicle will improve.

Kawamura, Noritaka, and Mitsuharu Muta[7] first initiative towards low-carbon society by Japan government for eco model society from 2008 . Toyota is the one of the 13 municipalities selected for the program .solar car charging system is located 20 km radius from Toyota city hall we have supported the reduction of CO_2 emissions at charging station PHEVs is the changing station and to charge we need to use pure natural energy provided by the sun therefore it is charged by the electricity generated by the solar cell The solar cell is capable of producing approximately 1,400kWh per year, reducing CO_2 emissions by 440 kg. The power conditioner converts DC power from solar generation or the power storage unit to AC power, and serves as the system's control center. When the electricity generated is not used for charging then it is stored in the power storage unit for future charging of PHEVs and EVs the solar charging system operates under four main modes depending on whether it is being used to charge PHEVs/EVs. There are four modes System is charging PHEVs/EVs, and power storage unit can provide electricity, System is charging PHEVs/EVs, and power storage unit cannot provide electricity, System is not charging PHEVs/EVs, and electricity can be charged to power storage unit and System is not charging PHEVs/EVs, and electricity cannot be charged to power storage unit.

Menasce, Daniel, Marthie Grobler, and Pieter Janse van Rensburg[8] The design of a solar car have a rules and this rules are regulated are contained in Technical Regulations for Alternative Energy Vehicles. The maximum area of the solar array is 6 m^2 for an array built from silicon photovoltaic cells. This limits teams to approximately 1kW of energy generation. Furthermore the car may not be more than 4m long and 1.8m wide. There is a mass limit to the size of the battery pack based on the chemistry or type of cells. A team member of the 2003 World Solar

Challenge winning team *Nuna 2*, analysed the difference between the first and second place teams in the 2011 World Solar Challenge. According to his calculations, a 10kg lighter car consumed 1.5% less energy, whilst 1% more efficiency in the electrical systems resulted in 1% more energy available to drive the vehicle. The main parameter used in the selection or design of component for solar car are the Electric Drive , *The Battery Pack and* Photovoltaic System .The design of solar car by student will help in developing the student engineering skill,team work, leadership and ownership.

Ahmed, Shehab, Ahmed Hosne Zenan, and Mosaddequr Rahman[9] The shape of the car is steam line to reduce the air drag and it is designed as two seats to improve the compactness of the car .the solar pannel is mounted on the roof of the car to collect the energy from the sun and convert it into usable electrical energy which is stored in the battery through the charge controller. In order to find the performance the present worth of all component .present worth of any item is the amount of money that need to be invested. The solar car with 2 seats contain 700 w motor with 48 v battery with a capacity of 40 hp and 200w solar panel will be required to supply the necessary power

Ashrafee, Farin, Sayidul Morsalin, and Asif Rezwan[10] At present time, energy crisis has turned into a bulk throughout the world. Besides resources are decreasing with population increase .At present in 2012 world averaged energy demand is 17TW and 85% of this comes from fossil fuel but in 2050 the demand will be 30TW.As there lies shortage of electric power in Southeast Asian country, it has become a vital issue to initiate the use of renewable energy in developing countries like Bangladesh for reducing the demand of electricity. The design of a car main component includes solar panel, wiper motor, wheels, shaft, battery, wood for frame, steel pipe for steering, tin plate for seat, washers, screws, clamps, pins Insulated wire etc. To invest in a project, an investor first has to think how much time it would need to recover his investments. The speed of the car can be increased by changing the car shape to airfoil. Because the value of drag coefficient is very small and this reduces the drag force. When the solar panel is charging the batteries, power tracker will help to protect the batteries being damaged by overcharging

2.3 Problem Definition

1. Consumption of excessive amount of fuels during transportation.
2. In Defense there is threat to soldier in Danger zone.
3. Handicapped people are dependent on another one.
4. Unavailability of Man Power in farming.

Certain plug-in electric vehicles that pull electricity from gas-fired plants produce up to 60 percent fewer emissions than a conventional car with an internal combustion engine. Hanergy says that five to six hours of sunlight should allow the cars' thin-film solar cells to generate between 8-10kWh of power a day, allowing the car to travel about 80km on solar power alone. Maximum range is about 350km.

Problem Solution:

1. Vehicle is Remotely Controlled.
2. Driverless vehicle.
3. Vehicle is not using fuel like petrol and diesel.
4. Very much Environmental savvy.

2.4 Objectives

Usually RC car is used to explore or access places that are not reachable by humans or which environment are dangerous for peoples. Some people also use it as purpose of Hobby and Racing Tournaments. Our Purpose of this Study is to apply this idea in our Campus. In our AIKTC campus, we can use it for security purpose near Gate, Parking Area and the open space in our campus to monitor the suspicious activities. As it has camera, with the help of it can be used for patrolling at night in our campus area

Improving safety of the driver

It is done by using impact detectors directly connected to the motor switch. So when there is a collision the motor switch turns off the entire system.

3. Working Methodology

3.1 Methodology

The sunlight hits the cells of the solar array, which produces an electrical current. The energy (current) can travel to the batteries for storage; go directly to the motor controller, or a combination of both. The energy sent to the controller is used to power the motor that turns the wheel and makes the car moves. Generally, if the car is in motion, the converted sun light is delivered directly to the motor controller, but there are times when there is more energy coming from the may than the motor controller needs. When this happens, the extra energy gets stored in the batteries for later use.

Arduino Uno

Arduino Uno is an Arduino Development Board using the microcontroller IC ATmega 328. Arduino Uno can be programmed using the Arduino software. Figure below shows the Arduino Uno SMD project board.

Figure 4 Arduino Uno Smd

Now we are going to explain about how the project was implemented. First step is programming Arduino and ESP8266, and L293D IC. The second step will be making the controller. Here, there is no physical controller being used because this project utilizes HTML page to control the car. The logic is, first we connect to the access point made by ESP8266, and then we navigate to the HTML page that function as controller, and in the HTML page there are some navigation buttons that can be pressed. After pressing the navigation button, it will send a command into the Arduino through the ESP8266. Arduino will interact with L293D

motor driver IC and will determine how the motor will act. The final step is to put all of the components in a chassis.

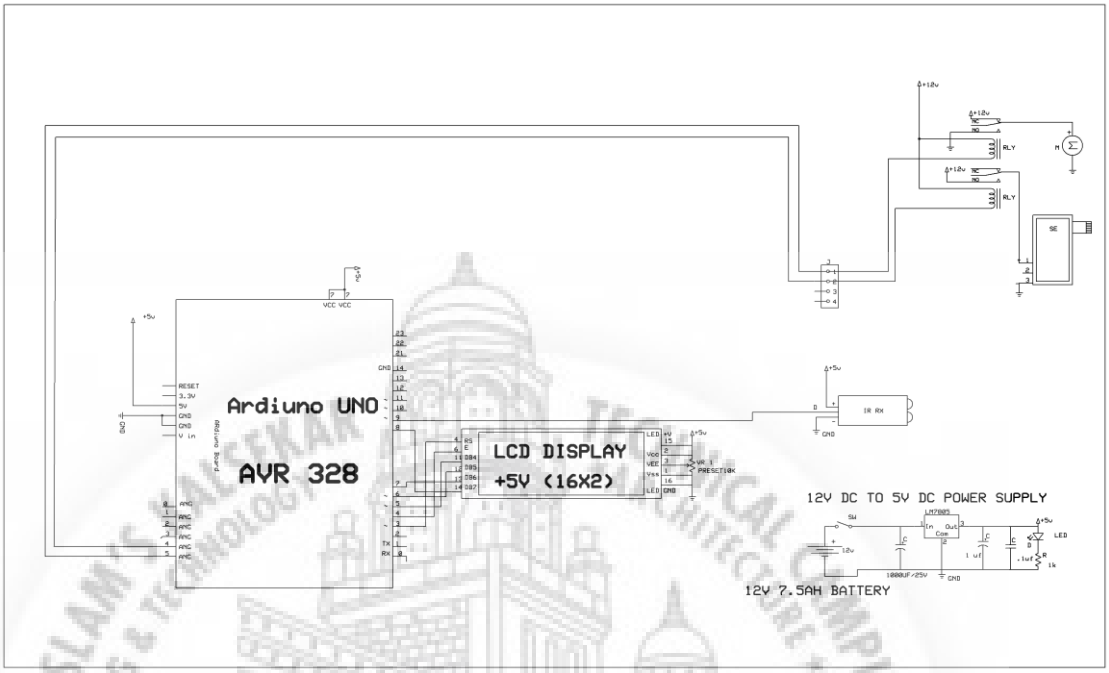


Figure 5 Circuit Diagram

3.2 Construction

Frame

The frame is usually made of mild steel. It is strong enough to withstand all types of loads in working condition. All other parts are fitted to the frame. Frame is helping the supporting of the various light load support. Frame shows the good aesthetic loop. every machine should have required the good frame design. Frame material should have high strength because frame balancing of other machine load. in ours project the frame showing important role. the vertical pulley and sprocket are mounted on vertical support of the frame. Main whole project assembly ours project mounted on frame. The proper selection of material for the different part of a machine is the main objective in the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials

Basic Frame The ms sheet meatal of material of mild steel are selected for the frame. The ms angles are cut into required size by cutting machine. The end of the ms angles cut into 90 degree(angle) to form rectangular frame. After cutting, the end is grinded so that it became smooth and convenient for welding. The sheets are welded together to form a rectangular basic frame.

MS SHEET METAL:

These ms sheets and mild steel sheets confirm to various standards like ANSI, API, MSS, BS, DIN, JIS & IS standards. We can provide these ms sheets and mild steel sheets in different grades, thickness, length and weight as per the requirements. Sheet metal is metal formed by an industrial process into thin, flat pieces. Sheet metal is one of the fundamental forms used in metalworking, and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal. Thicknesses can vary significantly; extremely thin sheets are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate steel or "structural steel".

Sheet metal is available in flat pieces or coiled strips. The coils are formed by running a continuous sheet of metal through a roll slitter.

In most of the world, sheet metal thickness is consistently specified in millimeters. In the India, the thickness of sheet metal is commonly specified by a traditional, non-linear measure known as its gauge.

Table 1 Sheet metal available sizes

Guage	Thickness mm	Weight kg/sq.m
8	4	31.4
9	3.55	27.9
10	3.15	24.75
11	2.8	22
12	2.5	19
13	2.25	17.6
14	2	15.7
15	1.8	14.15
16	1.6	12.55
17	1.4	11
18	1.25	9.8
19	1.12	8.8
20	1	7.85
21	0.9	7.05
22	0.8	6.3
24	0.63	4.95

26	0.5	3.9
28	0.4	3.15

Flexible solar panels:

Flexible solar panels are ultra-thin silicon wafers designed to capture solar energy. Unlike conventional solar panels that are heavy and bulky, flexible solar panels are only a few micrometers in thickness. Flexible solar cells are made by layering photovoltaic material on a 'base,' that is a substrate of high-grade plastic or glass. These cells are way thinner and much more flexible than a conventional mono or polycrystalline solar panel. The layered configuration of these ultra-thin solar cells allows for a more compact design to minimize the energy loss when overshadowed by clouds. Solar cells or photovoltaics collect the energy from the sun and converts it into usable electrical energy. They are made from silicon by joining an n-type and a p-type silicon semiconductor, creating an electron rich and an electron poor layer. When sunlight strikes the cell, photons cause atoms of the semiconductor to free electrons, leaving behind positive charges. The flow of electrons thus created constitutes an electromotive force that drives the current to charge a battery or power a motor.

The cell's positive contact is on the bottom while the negative contact, or bus bar, is located on the top of the cell. Each cell produces approximately .5 volts and 3 amps of current. Connecting the cells in series, i.e., positive to negative, increases voltage. Parallel connections, i.e., negative to negative and positive to positive, increase current. Therefore, connecting the cells in various series and parallel configurations produces modules of different voltages and currents. In our project 2 solar panels of 10 watts each is used.

DC MOTOR:

Almost every mechanical movement that we see around us is accomplished by an electric motor. Electric machines are a means of converting energy. Motors take electrical energy and produce mechanical energy. Electric motors are used to power hundreds of devices we use in everyday life. Motors come in various sizes. Huge motors that can take loads of 1000's of Horsepower are typically used in the industry. Some examples of large motor applications include elevators, electric trains, hoists, and heavy metal rolling mills. Examples of small motor applications include motors used in automobiles, robots, hand power tools and food blenders.

Micro- machines are electric machines with parts the size of red blood cells, and find many applications in medicine.

Here we are using 10 watt DC motors 4 nos.

Features: RPM=30 rpm

DC motor Voltage-12v

lithium-ion battery

Pioneer work with the lithium battery began in 1912 under G.N. Lewis but it was not until the early 1970s when the first non-rechargeable lithium batteries became commercially available. lithium is the lightest of all metals, has the greatest electrochemical potential and provides the largest energy density for weight.

Figure 6 Lithium ion battery

Attempts to develop rechargeable lithium batteries failed due to safety problems. Because of the inherent instability of lithium metal, especially during charging, research shifted to a non-metallic lithium battery using lithium ions. Although slightly lower in energy density than lithium metal, lithium-ion is safe, provided certain precautions are met when charging and discharging. In 1991, the Sony Corporation commercialized the first lithium-ion battery. Other manufacturers followed suit.

The energy density of lithium-ion is typically twice that of the standard nickel-cadmium. There is potential for higher energy densities. The load characteristics are reasonably good and behave similarly to nickel-cadmium in terms of discharge. The high cell voltage of 3.6 volts allows battery pack designs with only one cell. Most of today's mobile phones run on a single cell. A nickel-based pack would require three 1.2-volt cells connected in series.

Lithium-ion is a low maintenance battery; an advantage that most other chemistries cannot claim. There is no memory and no scheduled cycling is required to prolong the battery's life. In addition, the self-discharge is less than half compared to nickel-cadmium, making lithium-ion well suited for modern fuel gauge applications. lithium-ion cells cause little harm when disposed.

Advantages

- High energy density - potential for yet higher capacities.
- Does not need prolonged priming when new. One regular charge is all that's needed.
- Relatively low self-discharge - self-discharge is less than half that of nickel-based batteries.
- Low Maintenance - no periodic discharge is needed; there is no memory.
- Specialty cells can provide very high current to applications such as power tools.

WHEELS:

One of the most basic of mechanical devices, the wheel has been around in one form or another since about 6500 BC. It's likely that we will continue to use wheels for many millennia to come.

Robots, of course, have not been around for anywhere near that time, even fictional robots. And some robots don't even use wheels, tractor treads or legs are other methods of locomotion you could use. The size of the wheel is an obvious parameter to consider, and it can affect the design of many elements of your robot. The chassis design, the motor speed ratings and the motor controller programming are all affected by the size of the wheels. When we speak of the wheel size we usually are referring to its diameter, not its radius (which is half the diameter). The circumference of the wheel is the diameter multiplied by pi (about 3.1415926), and the circumference determines how far the robot will travel on one revolution of the wheel. The width of the wheel can affect the steering, especially when using skid steering. Skid steering is when you steer the robot by altering the speed of its wheels, DB1 uses this technique as do most hobbyist robots due to its simplicity. The wider the wheel the less accurate the skid steering will be. Other forms of steering, such as rack-and-pinion, do not suffer from this limitation.

However, a wider wheel can support more mass, as more of the wheel contacts the surface. The wheels used in project are 65 mm diameter, or 40 mm, wide.

Infrared Sensor:

IR Sensor module has great adaptive capability of the ambient light, having a pair of infrared transmitter and the receiver tube, the infrared emitting tube to emit a certain frequency, encounters an obstacle detection direction (reflecting surface), infrared reflected back to the receiver tube receiving, after a comparator circuit processing, the green LED lights up, while the signal output will output digital signal (a low-level signal), through the potentiometer knob to adjust the detection distance, the effective distance range 2 ~ 10cm working voltage of 3.3V-5V. The detection range of the sensor can be adjusted by the potentiometer, with little

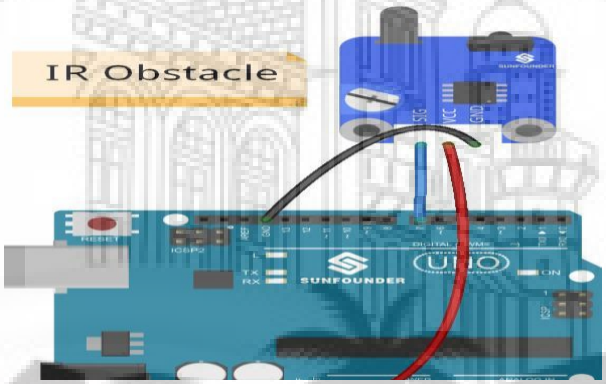


Figure 7 IR module connection

interference, easy to assemble, easy to use features, can be widely used robot obstacle avoidance, obstacle avoidance car assembly line count and black-and-white line tracking and many other occasions.

Features of IR Sensor Module:-

- When the module detects obstacles in front of the signal, the circuit board green indicator light level, while the OUT port continuous output low-level signals, the module detects a distance of 2 ~ 10cm, detection angle 35 °, the detection distance can be potential

adjustment with adjustment potentiometer clockwise, the increase in detection distance; counter clockwise adjustment potentiometer, the detection distance decreased.

- The sensor active infrared reflection detection, target reflectivity and shape of the detection distance of the key. *The black minimum detection range, white maximum;* small area object distance is small, a large area from the large.

- The sensor module output port OUT can be directly connected with the microcontroller IO port can also be driven directly to a 5V relay; Connection: VCC-Vcc; GND-Ground; OUT-Control.

- The comparator using LM393, stable.

- 3-5V DC power supply module can be used. When the power is turned on, the red power LED is lit.

- Each module in the delivery has threshold comparator voltage adjustable via potentiometer, special circumstances, please do not adjust the potentiometer.

Figure 8 IR sensor module

Spray paint can:

Spray paint, also known as aerosol paint, is paint that's stored in a pressurized container and dispensed using a valve to release a mixture of paint and a propellant, usually pressurized gas or compressed air. The result is a fine, even mist that is easily applied to a variety of surfaces. Spray painting is one of three primary methods for paint application besides using a paintbrush or a roller, and is generally quicker, cleaner, and easier to achieve a uniform coat.

Spray paint started becoming a steadfast friend to do-it-yourselfers when American artist Francis Davis Millet developed an oil and lead mixture that could be sprayed to speed up preparations for the Chicago World's Fair. But it was Edward Seymour who thought to use an aerosol spray to dispense paint. In 1949, he demonstrated a new aluminum paint designed for finishing radiators on a large scale quickly. Aerosol spray cans had been around since Norwegian engineer Eric Rotheim invented the first one in 1931, and Seymour was simply piggybacking on this innovation as a way to showcase his own product [source: Harris]. But he was so intrigued by this new method of paint delivery that he directed his company, Seymour of Sycamore, to dedicate considerable resources to exploring its potential [source: Seymour of Sycamore].

Figure 9 spray can

Around the same time Seymour was working on his contributions to spray paint, Krylon and Crown Holdings Inc. were each developing new can designs that eventually gave rise to the metal cylinders we use today [source: Sattler]. They were smaller, lighter, cleaner and applied an even coat faster than a brush or roller could, making those small paint projects around the house a lot more manageable. And once the manufacturing industry discovered its benefits, spray paint went from a resourceful and useful invention to a full-blown industrial boon.

Today, spray paint comes in enamels, stains, flats and glossies, and there are varieties designed for virtually any surface, including wood, metal, glass, plastic and masonry. In other words, if it can be painted, there's probably a spray paint that can do the job.

The various machining operations conducted after material selection are as follows:

PROCESS SHEET:

Following operations were while fabricate the project

Cutting: -

Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force.

Implements commonly used for cutting are the knife and saw, or in medicine and science the scalpel and microtome. However, any sufficiently sharp object is capable of cutting if it has a hardness sufficiently larger than the object being cut, and if it is applied with sufficient force. Even liquids can be used to cut things when applied with sufficient force (see water jet cutter).

The material as our required size. The machine used for this operation is power chop saw. A power chop saw, also known as a drop saw, is a power tool used to make a quick, accurate crosscut in a work piece at a selected angle. Common uses include framing operations and the cutting of moulding. Most chop saws are relatively small and portable, with common blade sizes ranging from eight to twelve inches.

Figure 10 Cutting Operation

The chop saw makes cuts by pulling a spinning circular saw blade down onto a work piece in a short, controlled motion. The work piece is typically held against a fence, which provides a precise cutting angle between the plane of the blade and the plane of the longest work piece edge. In standard position, this angle is fixed at 90°. A primary distinguishing feature of the mitre saw is the mitre index that allows the angle of the blade to be changed relative to the fence. While most mitre saws enable precise one-degree incremental changes to the mitre index, many also provide "stops" that allow the miter index to be quickly set to common angles (such as 15°, 22.5°, 30°, and 45°).

Welding: -

Welding is a ((fabrication or sculptural ((process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion. Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal.

In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal). Pressure may also be used in conjunction with heat, or by itself, to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized.

Square pipes of different lengths to make frame. The machine used for this operation is electric arc welding. Electrical arc welding is the procedure used to join two metal parts, taking advantage of the heat developed by the electric arc that forms between an electrode (metal filler) and the material to be welded. The welding arc may be powered by an alternating current generator machine (welder). This welding machine is basically a single-phase static transformer Suitable for melting RUTILE (sliding) acid electrodes. Alkaline electrodes may also be melted by alternating current.

Figure 11 Welding operation

The welding current is continuously regulated (magnetic dispersion) by turning the hand wheel on the outside of the machine, which makes it possible to select the current value, indicated on a special graded scale, with the utmost precision. To prevent the service capacities from being exceeded, all of our machines are fitted with an automatic overload protection which cuts of the power supply (intermittent use) in the event of an overload. The operator must then wait for a few minutes before returning to work. This welding machine must be used only for the purpose described in this manual. Read the entire contents of this manual before installing, using or servicing the equipment, paying special attention to the chapter on safety precautions. Contact your distributor if you do not fully understand these instructions. The time required for this operation is 120 minutes.

Drilling: -

Drilling is a cutting process that uses a drill bit to cut a hole of circular ((cross-section in solid materials. The drill bit is usually a rotary ((cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled.

In ((rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside the hole ((top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills.

In rare cases, specially-shaped bits are used to cut holes of non-circular cross-section; a ((square cross-section is possible.

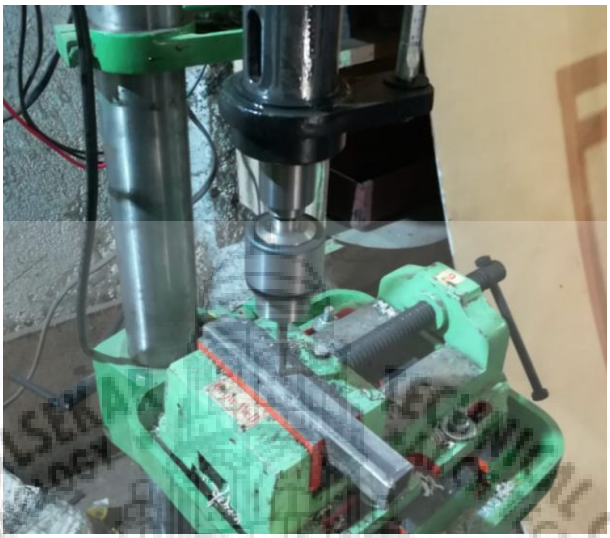


Figure 12 Drilling Operation

Drilled holes are characterized by their sharp edge on the entrance side and the presence of ((burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks.

Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the hole opening and a very thin layer of highly ((stressed and disturbed material on the newly formed surface. This causes the work piece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions.

For ((fluted drill bits, any chips are removed via the flutes. Chips may form long spirals or small flakes, depending on the material, and process parameters. The type of chips formed can be an indicator of the machinability of the material, with long chips suggesting good material machinability.

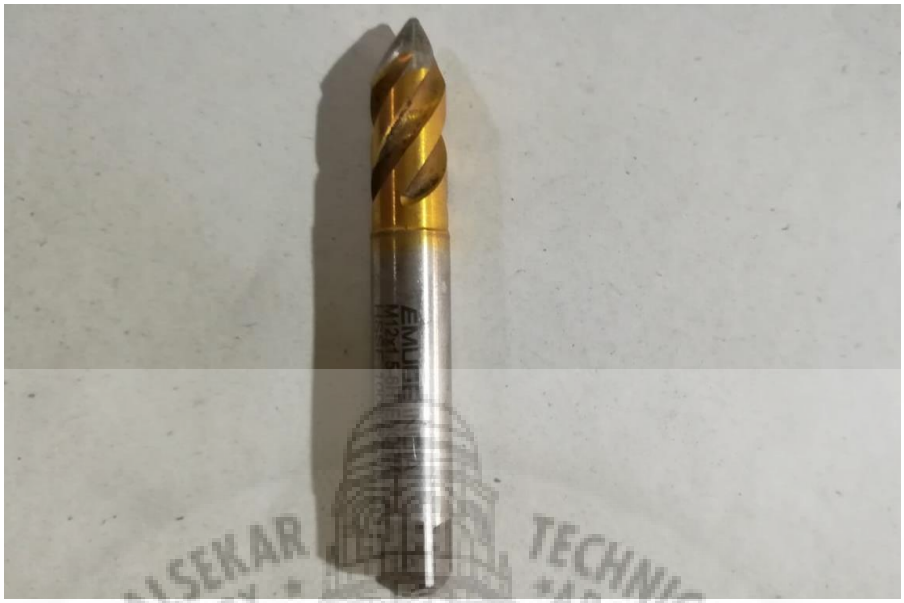


Figure 13 Drilling Tool

Finishing: -

Finishing is a broad range of industrial processes that alter the surface of a manufactured item to achieve a certain property. Finishing processes may be employed to: improve appearance, adhesion or wettability, solder ability, corrosion resistance, tarnish resistance, chemical resistance, wear resistance, hardness, modify electrical conductivity, remove burrs and other surface flaws, and control the surface friction. In limited cases some of these techniques can be used to restore original dimensions to salvage or repair an item.

An unfinished surface is often called mill finish.

The edges with grinder using grinding wheel. The machine used for this operation is hand grinder. An angle grinder, also known as a side grinder or disc grinder, is a handheld power tool used for cutting, grinding and polishing. Angle grinders can be powered by an electric motor, petrol engine or compressed air.

The motor drives a geared head at a right-angle on which is mounted an abrasive disc or a thinner cut-off disc, either of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side-handle for two-handed operation. Certain angle grinders, depending on their speed range, can be use*d* as sanders, employing a sanding disc with a backing pad or disc. The backing system is typically made of hard plastic, phenolic resin, or medium-hard rubber depending on the amount of flexibility desired. The time required for this operation is 20 minutes.

Figure 14 Finishing Operation

Polishing: -

Polishing is the process of creating a smooth and shiny surface by rubbing it or using a chemical action, leaving a surface with a significant specular reflection (still limited by the index of refraction of the material according to the Fresnel equations.) In some materials (such as metals, glasses, black or transparent stones), polishing is also able to reduce diffuse reflection to minimal values. When an unpolished surface is magnified thousands of times, it usually looks like mountains and valleys. By repeated abrasion, those "mountains" are worn down until they are flat or just small "hills." The process of polishing with abrasives starts with coarse ones and graduates to fine ones.

The welded joints with hand grinder using grinding wheel. The machine used for this operation is hand grinder. With refinement, grinding becomes polishing, either in preparing metal surfaces for subsequent buffing or in the actual preparation of a surface finish, such as a No. 4

polish in which the grit lines are clearly visible. Generally speaking, those operations which serve mainly to remove metal rapidly are considered as grinding, while those in which the emphasis is centred on attaining smoothness are classified as polishing. Grinding employs the coarser grits as a rule while most polishing operations are conducted with grits of 80 and finer. If polishing is required, start with as fine a grit as possible to reduce finishing steps. There is a wide range of grinding and polishing tools on the market and advice is available from ASSDA members to assist in particular applications. Polishing operations are conducted with the abrasive mounted either on made-up shaped wheels or belts which provide a resilient backing. The base material may be in either a smooth rolled or a previously ground condition. If the former, the starting grit size may be selected in a range of 80 to 100. If the latter, the initial grit should be one of sufficient coarseness to remove or smooth out any residual cutting lines or other surface imperfections left over from grinding. In either case, the treatment with the initial grit should be continued until a good, clean, uniform, blemish-free surface texture is obtained. The initial grit size to use on a pre-ground surface may be set at about 20 numbers finer than the last grit used in grinding, and changed, if necessary, after inspection. Upon completion of the initial stage of polishing, wheels or belts are changed to provide finer grits. Polishing speeds are generally somewhat higher than those used in grinding. A typical speed for wheel operation is 2500 meters per minute. The time required for this operation is 20 minutes.

Figure 15 Polishing Operation

Turning:

Turning is a metal cutting process for producing a cylindrical surface with a single point tool. The work piece is rotated on a spindle and the cutting tool is fed into it radially, axially or both. Producing surfaces perpendicular to the work piece axis is called facing. Producing surfaces using both radial and axial feeds is called profiling.

A *lathe* is a machine tool which spins a block or cylinder of material so that when

abrasive, cutting, or deformation tools are applied to the work piece, it can be shaped to produce an object which has rotational symmetry about an axis of rotation. Examples of objects that can be produced on a lathe include candlestick holders, table legs, bowls, baseball bats, crankshafts, camshafts, and bearing mounts. Lathes have three main components:

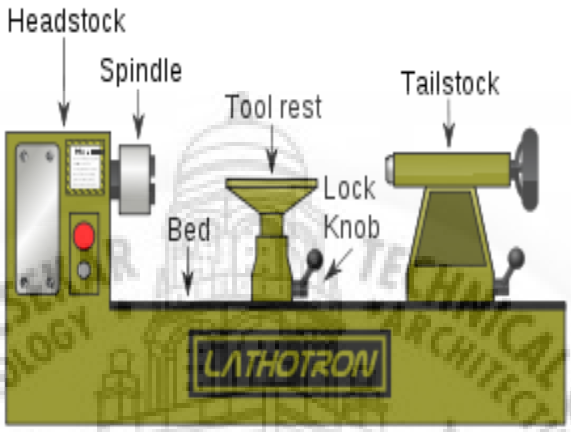


Figure 16 ***Lathe***

Headstock:

The headstock's spindle secures the work piece with a chuck, whose jaws (usually three or four) are tightened around the piece. The spindle rotates at high speed, providing the energy to cut the material. While historic lathes were powered by belts from the ceiling, modern examples uses electric motors. The work piece extends out of the spindle along the axis of rotation above the flat bed.

Carriage:

The carriage is a platform that can be moved, precisely and independently, horizontally parallel and perpendicular to the axis of rotation. A hardened cutting tool is held at the desired height (usually the middle of the work piece) by the tool post. The carriage is then moved around the rotating work piece, and the cutting tool gradually shaves material from the work piece

Tailstock:

The tailstock can be slid along the axis of rotation and then locked in place as necessary.

It may hold centers to further secure the work piece, or cutting tools driven into the end of the work piece.

Safety Precautions:

The following points should be considered for the safe operation of machine

and to avoid accidents: -

- All the parts of the machine should be checked to be in perfect alignment.
- All the nuts and bolts should be perfectly tightened.
- The operating switch should be located at convenient distance from the operator so as to control the machine easily.
- The inspection and maintenance of the machine should be done from time to time.

3.2 Decision Making Process

No methodology is available for material and method selection except decision making in multi attribute environment. Material selection is vital and crucial activity in any industry nowadays. This substantially reduces the risk of wrong material or method selection.

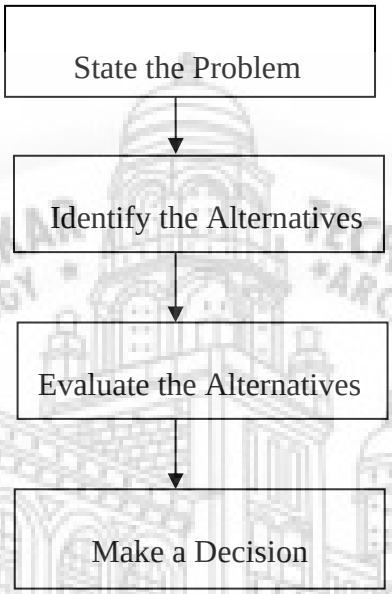


Figure 17 Decision Making Processes

3.3 Project Pan

Following fig explains the steps for experiment. The process flow mentioned above will be considered to meet the goal of research work.

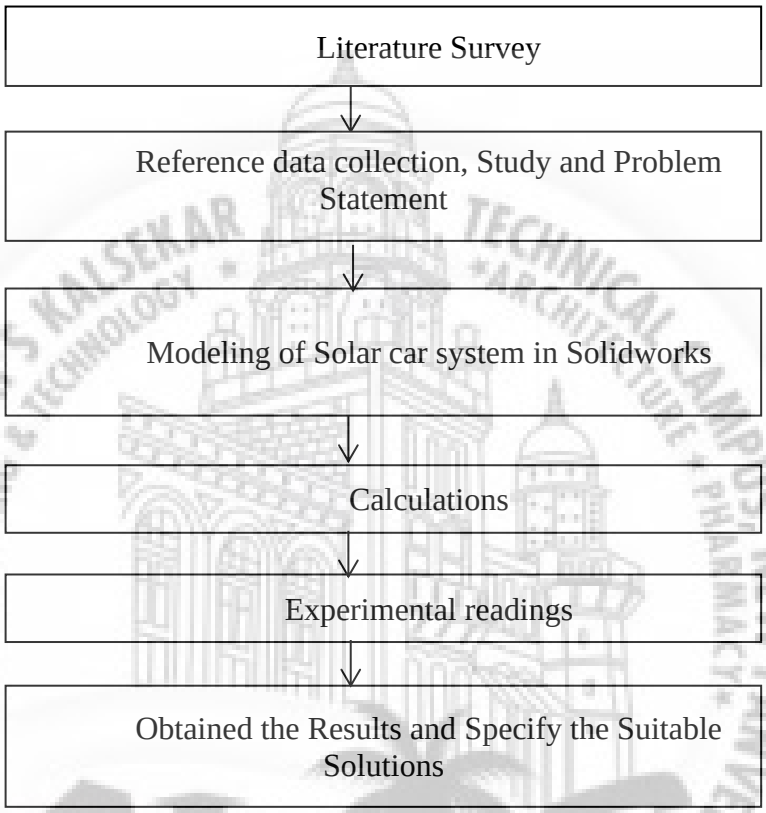


Figure 18 Steps of Execution

3.5 Cad drawing

Procedure

- The entire model has been designed with the help of designing software solid works.
- With the help of colour feature the colours are given to the entire model.

Figure- Cad model of the assembled project is designed on Solidworks 2018 software

SOLID MODELING

The entire model has been designed with the help of designing software solid works.

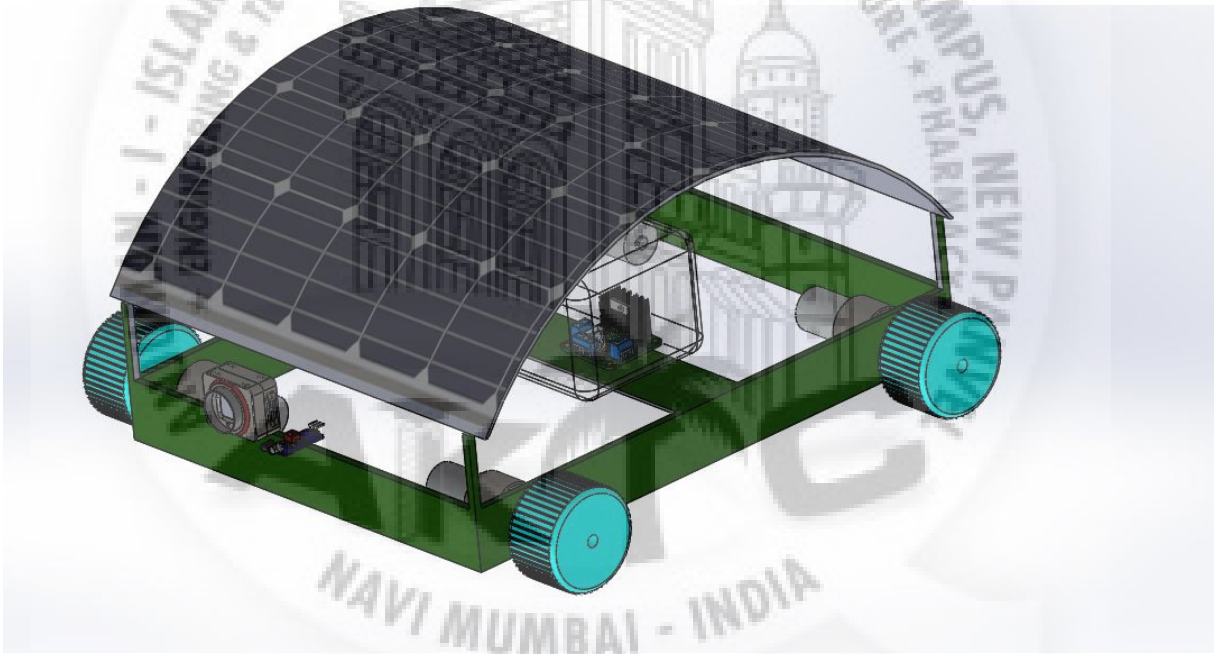


Figure 19 isometric front view

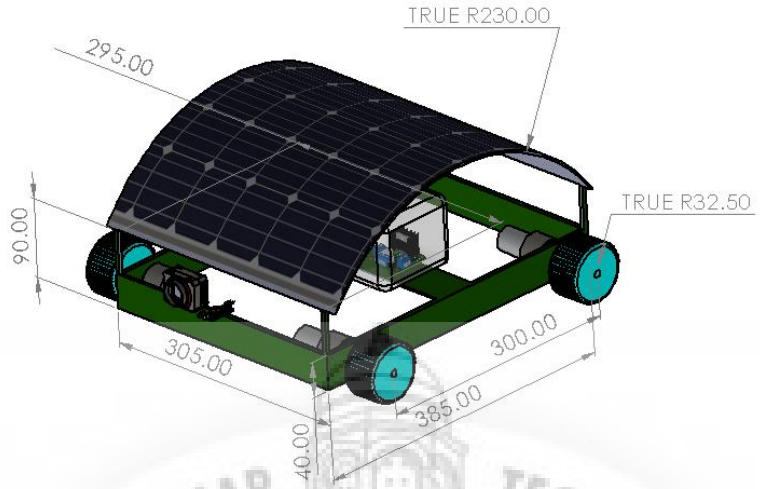


Figure 20 drafting

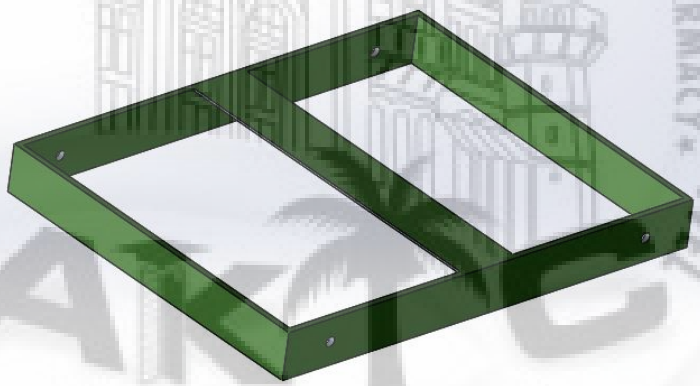


Figure 21 chassis

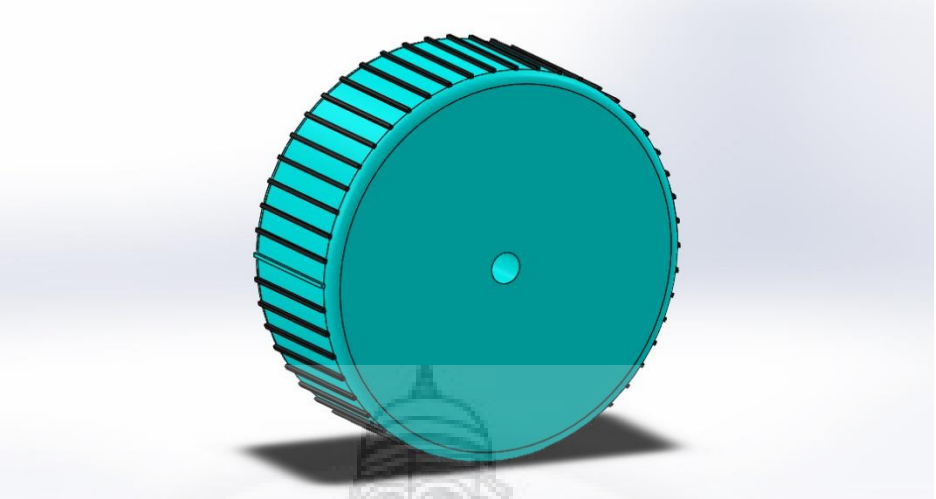


Figure 22 wheel

Figure 23 motor shaft

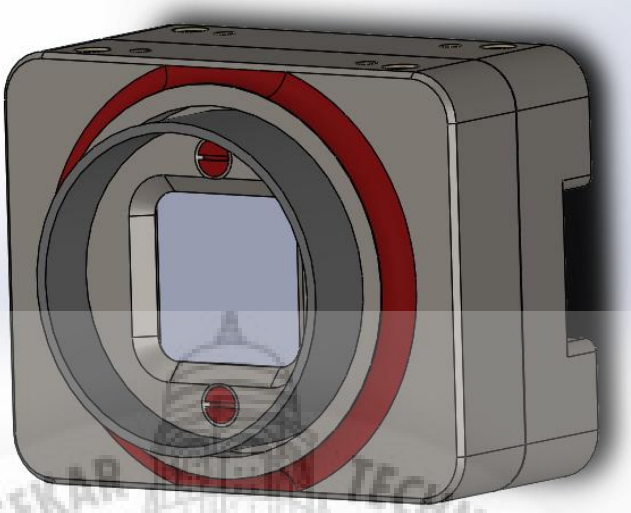


Figure 24 Camera

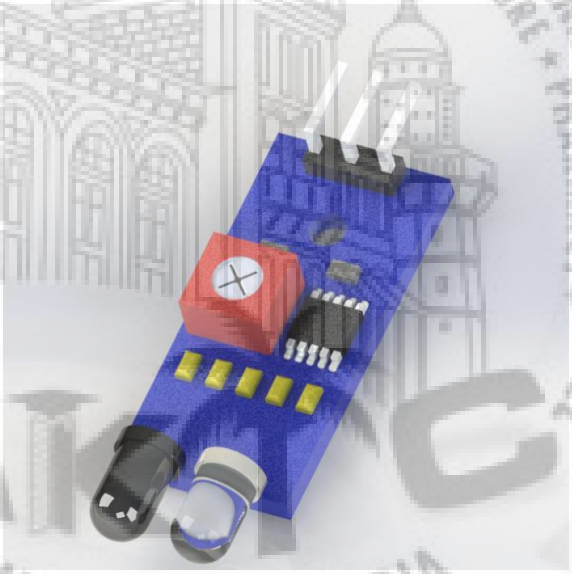


Figure 25 IR sensor

3.6 Calculations

EN 10083 C45 steel carbon steel

C45 steel sheet Physio-chemical testing items for products of the plant include tensile test ,hardness test ,impact test ,flattening test ,and chemical composition analysis, etc .C20,C45 steel pipes are manufactured by cold drawn process.

C45 is a medium carbon steel is used when greater strength and hardness is desired than in the "as rolled" condition. Extreme size accuracy, straightness and concentricity combine to minimize wear in high speed applications. Turned, ground and polished.

Soft Annealing

Heat to 680-710oC, cool slowly in furnace. This will produce a maximum Brinell hardness of 207.

Normalizing
Normalizing temperature: 840-880oC/air.

Hardening
Harden from a temperature of 820-860oC followed by water or oil quenching.

Tempering
Tempering temperature: 550-660oC/air.

C45 steel plate, EN 10083 C45 steel plate, under EN 10083 standard, we can regard C45 steel plate as high carbon steel.

C45 steel plate is one mainly of high carbon steel, EN 10083 C45 steel plate is for quenching and tempering. Technical delivery conditions for non-alloy steels, these steels are for general engineering purposes

	Comparison of steel grades	
C45 EN 10083-2	JIS G 4051	S 45 C
	DIN 17200	C 45
	NFA 33-101	AF65-C 45

Number:1.0503	UNI 7846	C 45
	BS 970	070 M 46
	UNE 36011	C 45 k
	SAE J 403-AISI	1042/1045

Table 2 steel gardes

Chemical Composition of EN C45 steel

Grade	C(%)min-max	Si(%)min-max	Mn(%)min-max	P(%)max	S(%)max	Cr(%)min-max
C45	0.42-0.50	0.15-0.35	0.50-0.80	0.025	0.025	0.20-0.40

Table 3 Chemical Composition

Mechanical Properties of EN C45 steel

Grade	Condition	Yield Strength R°(Mpa)	Tensile Strength Rm (Mpa)	Elongation A5(%)	Hardness HRC	Quenching Temperature (°C)	Benda-bility	Nominal Thickness,t 1.95mm≤t≤10.0mm	
								Rolled	Annealed
C45	Rolled Annealed Water-quenched Oil quenched	460 330	750 540 2270 1980	18 30	58 55	820 860	Min.reco-mmended Bending radius (≤90°)	2.0 ×t	1.0×t

Table 4Mechanical Properties of EN C45 steel

Properties of steel C45 (1.0503) Properties of steel C45 (1.0503)

Weldability: Due to the medium-high carbon content it can be welded with some precautions.

Hardenability: It has a low hardenability in water or oil; fit for surface hardening that gives this steel grade a high hardness of the hardened shell.

Product Information

ITEMS INFO

SPECIFICATION FOR OPTION:

Round bar	Diameter: 4mm~800mm or as required
Steel plate	Thick:8mm~300mm, Width:100mm~2300mm
Angle bar	Size:3mm*20mm*20mm~12mm*800mm*800mm
Square bar	Size: 4mm*4mm~100mm*100mm
	Width:10mm~2000mm
Hexagonal	Size: 4mm~800mm
Length: 2m,4m,5.8m,6m,11.8m,12m or as required	

MECHANICAL PROPERTY:

Annealing	Forging	Tempering and Hardening	Normalization
Subcritical annealing: 650~700	1100~850	Tempering: 550~660	840~880
Isothermal annealing: 820~860		Hardening : 820~860 water	

CHEMICAL COMPOSITION:

NO.	C	Mn	Si	Cr	Cu	Ni	P	S
Aisi 1045	0.43~0.50	0.6~0.9	0.10~0.60				≤0.040	≤ 0.050
DIN1.1191	0.42~0.48	0.6~0.9	0.15~0.35	≤0.15	≤0.3	≤0.2		
JIS S45C	0.42~0.50	0.5~0.8	≤0.40	≤0.40		≤ 0.4		
C45	0.42-0.50	0.5~0.8	0.4~0.8				≤0.035	≤0.035
GB45	0.42~0.50	0.5~0.8	0.17~0.37	≤0.25	≤0.25	≤0.3	≤0.035	≤0.035
EN8	0.42~0.48	0.6~0.9	0.15~0.35	≤0.20	≤0.30	≤0.20	≤0.030	≤0.030

CCSI CCS INDUSTRIAL CORP. CE SGS

Figure 26 Properties of steel C45

Why Mild steel C-45 is selected in our project.

Easily available in all sections.

Welding ability

Machinability

Cuttingablity

Cheapest in all other metals.

Material = C 45 (mild steel)

Take fos 2

$\sigma_t = \sigma_b = 540/fos = 270$ *N/mm²*

$\sigma_s = 0.5\ \sigma_t$

= 0.5 x 270

= 135 N/mm²

1. **Design of dc motor**

Power of motor = 10 N- m /s
Rpm of motor = 30 rpm

CALCULATION FO FINAL SPEED & TORQUE OF MOTOR

Power of motor = P = 10 watt.

$$P = \frac{2\pi N T}{60}$$

Where, N→ Rpm of motor = 30

T →Torque transmitted

$$10 = \frac{2\pi \times 30 \times T}{60}$$

T = 3.182696317 N-m
T = 3182.696 N-mm

T = Force × radius

3182 = F × 32.5

F = 97.90 N

$$F = \frac{97.90\ N}{9.81}$$

F = 9.9 Kg

This the force generated by individual motor, total force generated will be 39.9 kg

2. Speed of car

$V = \pi DN/60$

V = 3.142 x 0.065 x 30 / 60

V = 0.102 m/s

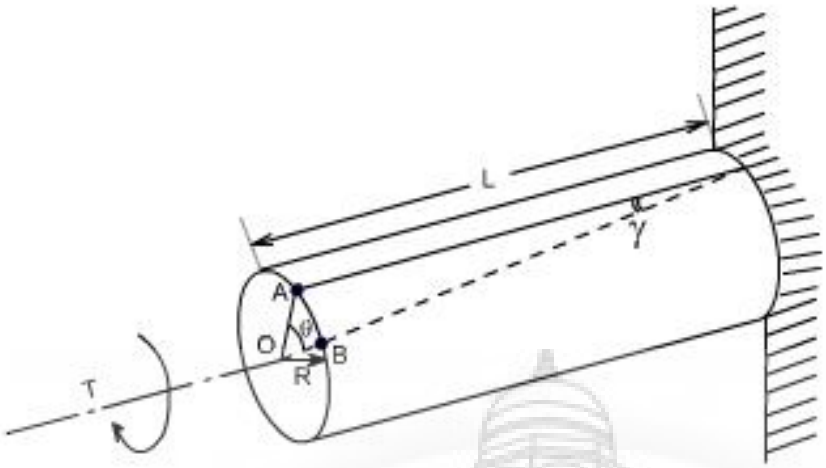
1 m/s = 3.6 km/hr

So,

V = 0.3672 km/hr

3. Design of shaft

Now, T is the maximum torque among all shafts, so we will check shaft for failure here.



$T=\pi/16 \times 135 \times d^3$

$d^3=3182 \times 16 / 3.142 \times 135$

d= 4.93 mm

But we are using 8 mm shaft so our motor so design is safe.

4. Design of transverse fillet welded joint.

Hence, selecting weld size = 3.2mm

Area of Weld = 0.707 x Weld Size x L

= 0.707 x 3.2 x π x 20

= 142.150 mm^2

Force Exerted = 30 x 9.81

= 300 N

Stress induced = Force Exerted / Area of Weld

= 300 / 142.15

= 2.11 N/mm^2

For filler weld:

Maximum Allowable Stress for Welded Joints = 210 Kgf/ cm^2

= 21 N/mm^2

Hence Safe.

5. **Time required for full battery charge**

The solar panel used here is 20 watt

And battery used here is 3 amp, 3.7 v x 2 nos

So total wattage = 22.2 of battery

22.2/20 = 1.11

1.11 x 60 = 66.6 minutes

3.7 COST ESTIMATION

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involved in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

PURPOSE OF COST ESTIMATING:

1. To determine the selling price of a product for a quotation or contract so as to ensure a reasonable profit to the company.
2. Check the quotation supplied by vendors.
3. Determine the most economical process or material to manufacture the product.
4. To determine standards of production performance that may be used to control the cost.

BASICALLY THE BUDGET ESTIMATION IS OF TWO TYRES:

1. material cost
2. Machining cost

MATERIAL COST ESTIMATION:

Material cost estimation gives the total amount required to collect the raw material which has to be processed or fabricated to desired size and functioning of the components.

These materials are divided into two categories.

1. Material for fabrication:

In this the material in obtained in raw condition and is manufactured or processed to finished size for proper functioning of the component.

1. Standard purchased parts:

This includes the parts which was readily available in the market like Allen screws etc. A list is forecast by the estimation stating the quality, size and standard parts, the weight of raw material and cost per kg. For the fabricated parts.

MACHINING COST ESTIMATION:

This cost estimation is an attempt to forecast the total expenses that may include to manufacture apart from material cost. Cost estimation of manufactured parts can be considered as judgment on and after careful consideration which includes labour, material and factory services required to produce the required part.

PROCEDURE FOR CALCULATION OF MATERIAL COST:

The general procedure for calculation of material cost estimation is

1. After designing a project, a bill of material is prepared which is divided into two categories.
    a. Fabricated components
    b. Standard purchased components
2. The rates of all standard items are taken and added up.
3. Cost of raw material purchased taken and added up.

LABOUR COST:

It is the cost of remuneration (wages, salaries, commission, bonus etc.) of the employees of a concern or enterprise.

Labour cost is classifies as:

a. Direct labour cost
b. Indirect labour cost

Direct labour cost:

The direct labour cost is the cost of labour that can be identified directly with the manufacture of the product and allocated to cost centers or cost units. The direct labour is one who counters the direct material into saleable product; the wages etc. of such employees constitute direct labour cost. Direct labour cost may be apportioned to the unit cost of job or either on the basis of time spend by a worker on the job or as a price for some physical measurement of product.

Indirect labour cost:

It is that labour cost which cannot be allocated but which can be apportioned to or absorbed by cost centers or cost units. This is the cost of labour that doesn't alters the construction, confirmation, composition or condition of direct material but is necessary for the progressive movement and handling of product to the point of dispatch e.g. maintenance, men, helpers, machine setters, supervisors and foremen etc.

EXPENSES

The expenses are also mainly divided into direct and indirect labour expenses.

1) Direct expenses

The expenses which can be directly cragged on cost of particular product are called direct expenses.

2) indirect expenses

The expenses that cannot be charged directly on the cost of particular product are called indirect expenses

PROCEDURE OF COSTING

Actual expenditure incurred in various departments for costing collects different items. The expenditure is categorized under the following main heads. All the expenses made by an industry may be group into various components of cost.

The various components of cost are under:

It should be noted that it is cumulative as shown. This system is used in most of modern industries irrespective of their size. It is because this type of classification is very helpful in analyzing cost compounds according to modern management techniques.

(a) Prime cost

it is also referred as direct cost and is comprised of the direct material cost, direct labour cost and direct expenses incurred on the manufacturing of product.

Prime cost =Direct material cost + Direct labour cost + Direct expenses

(b) Factory cost

it is also referred as works cost and is comprised works overhead.

Factory cost = Prime cost + Factory over head

(c) Office cost

it is also referred as production cost of manufacturing, cost is comprised of factory cost and administrative over heads or office on cost.

Office cost = Factory cost + Administrative over heads

(d) Total cost

it is also referred as ultimate cost or gross cost and is comprised of the Office cost and selling and distribution overhead

total cost = Office cost + Selling and distribution overhead

(e) Selling price

When profit or loss of organization is added / subtracted to the total cost of the product we get selling price.

selling price = Total cost + Profit or loss

(f) Market price

it is also referred as catalogue price or list price some percentage of discounts is always allowed to the distributors, when this discount to the distribution is added to the selling price we get market price.

market price = Selling price + Discount to the distributors

Machines & equipment's required

Required machine tools

- Lathe machine
- Welding machine
- Hacksaw machine
- Grinding machine
- Drilling machine
- Slotting machine

Required tools /equipment's

- Hacksaw blade
- Spanner set
- Hammer
- Drill bit
- Fasteners
- Welding electrodes
- Center punch
- Measure tape
- Chisel
- Single point cutting tool
- Steel rule
- Rough, smooth file

Required fixture

- Bench vice
- Anvil
- C-clamp
- Drill machine vice

Other requirement

- Lubricating oil
- Cutting fluid
- Coolant
- Paint

The total labour cost is calculated on the basis of wages paid to the labour for 8 hours per day.

Cost estimation is done as under

Cost of project = (A) material cost + (B) Machining cost + (C) labour cost

(A) Material cost is calculated as under: -

i) Raw material cost

ii) Finished product cost

i) Raw material cost: -

It includes the material in the form of the Material supplied by the "Steel authority of India limited" and 'Indian aluminium co.,' as the round bars, angles, square rods, plates along with the strip material form. We have to search for the suitable available material as per the requirement of designed safe values. We have searched the material as follows: -

Hence the cost of the raw material is as follows: -

RAW MATERIAL & STANDARD MATERIAL

SR NO	PART NAME	MAT	QTY	COST
1	PMDC 30 RPM GEAR MOTOR	STD	4 NO	1600
2	AURDINO UNO	STD	1 NO	600
3	RELAYS	STD	8 NO	750
4	POWER SUPPLY	STD	1 NO	300

5	LITHIUM ION BATTERY	STD	2 NO	1100
6	CIRCUIT BOX	STD	1 NO	100
7	CAMERA	STD	1 NO	1300
8	IR SENSOR	STD	1 NO	550
9	CABLES	STD	2 M	100
10	AURDINO TO PC CABLE	STD	1 NO	250
11	SOLAR PANEL 14 V	STD	1 NO	1200
12	HC 05 BLUETOOTH MODULE	STD	1 NO	330
13	MISCELLINOUS	-	-	500
	TOTAL			8680

Table 5 raw material cost

B) **DIRECT LABOUR COST:-**

SR. NO.	OPERATION	HOURS	RATE LABOUR	AMOUNT
1.	Turning	5	150	750
2.	Drilling	7	100	700
3.	Welding	16	175	2800
4.	Grinding	3	60	180
5.	Tapping	3	40	120
6.	Cutting	8	40	320
7.	Assembly	2	100	200
8.	Painting	2	100	200
			TOTAL	5270/-

Table 6 labour cost

INDIRECT COST

Transportation cost = 500/-

Coolent & lubricant = 100/-

Drawing cost = 500/-

Project report cost = 2000/-

TOTAL INDIRECT COST = 2100/-

TOTAL COST

Raw Material Cost + STD Parts Cost + Direct Labour Cost +Indirect Cost

Total cost of project is done in table

TOTAL COST	AMOUNT
A	8680
B	5270
C	2100
Total cost of project	16050

Table 7 Final cost

3.8 Plan of execution:

Months/ Activity	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
A												
B												
C												
D												
E												
F												
G												
H												
I												
J												

Table 8Plan of Work/Timeline

Activities

- A= Topic finalization
- B= Literature Review

- C= Formulation of Problem
- D= Parametric analysis
- E=Development of CAD models of system
- F= Purchasing of components
- G= Manufacturing
- H= Assembly and Testing
- I= Results and Conclusion
- J= Report Writing

3.9 PROJECT FLOW CHART

From the flow chart, this project started with the objective of the project. The objective of the project must follow the title. The objective must fulfill the title Then follow up with design review about folding table and then study a lot of investigation about folding table. This is including study about several of stage, type of stage, types of material which suitable to make a stage. These tasks have been done through study on internet, books and others resources. After all information had been collected and gathered, the project continued with the design process. All the knowledge and lessons had been applied to make a suitable design for the project. After several design sketched, design consideration have been made and one of the design have been chosen by using Pugh's concept selection. The solid modeling and engineering drawing by using solid works software the fabrication process progress use drawing as a reference. The process consist fabrication to all parts that have been designed by the dimension using various type of manufacturing process. The manufacturing process includes welding, drilling, bending, cutting and etc. During the fabrication process, if there have error occur, such as fabrication error, so the process need to modification the process need to go back to the previous step and the process flow again, until no error occur the process can been continued smoothly until the final product finished. Then, the draft report need to be submitted to the supervisor for double checking if there had an error.

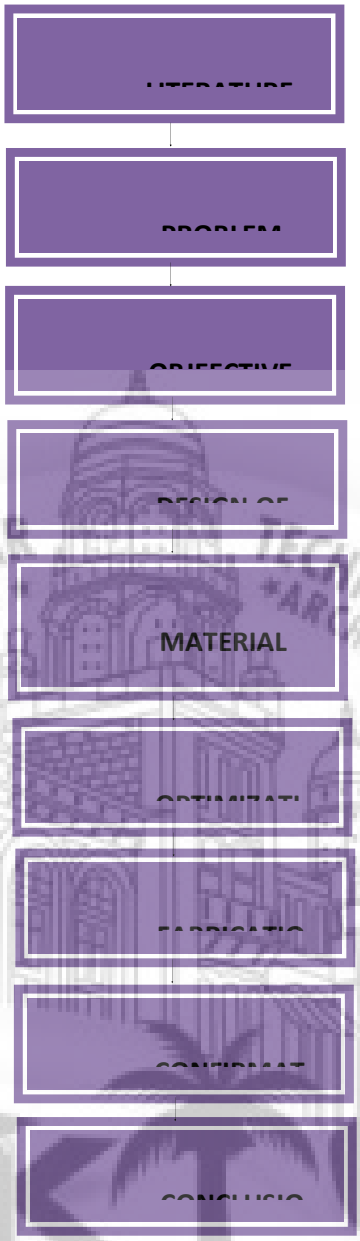


Figure 27 flow chart

4. Results and discussion

Readings		
SR NO	DISTANCE	BRAKING TIME
1	100 mm	2 sec
2	200 mm	2.2 sec
3	300 mm	2.5 sec
4	400 mm	2.8 sec
5	500 mm	3 sec
6	600 mm	3.2 sec

Table 9 Result table

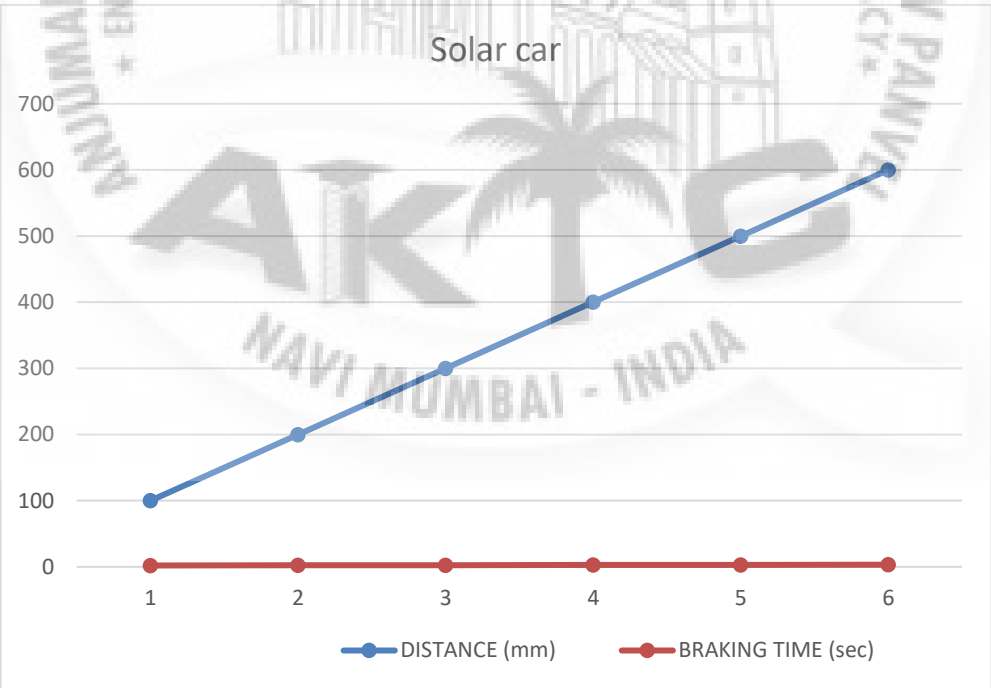


Table 10 Reading Graph

5. Conclusion and Future scope

Conclusion

This project of solar car with camera and Infrared sensor is successfully design, fabricated and demonstrated the readings are properly taken with appropriate graph and is also generated. The project gives us desired result as we were expecting and proper camera images is stored in it. The project it is operated by using mobile app the project is designed and developed on Arduino microcontroller integrated with hc-05 Bluetooth module and camera IR sensor is also implemented for detecting obstacle in front of it. Flexible solar panels are used in project to keep it very lightweight and give it aerodynamic design flexible solar panel charge the battery in only one hour

Future scope

- Augmented Car is a project that its hardware can come from devices that people may already own, such as smartphones or RC cars, and from inexpensive devices and materials that are widely available in the market.
- By using the already developed software that can be run on the majority of the devices, one can easily construct Augmented Cars at very low costs ranging from Rs.3000 to Rs.4000 for educational or recreational purposes.
- Furthermore, the software used in this project consists entirely of free or open-source code and applications and has much more capabilities to make use of.
- Additionally, this project has commercialization potential after some improvements and extensions. By proper funding and industrialized development (wholesale production and use of inexpensive and specifically tailored materials), the Augmented Car could become a popular product for recreational use, as it is an affordable and an easy-to-use remote controlled vehicle that utilizes the growing number of capabilities of modern smartphones

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