DESIGN AND FABRICATION OF AUTOMATIC BEACH CLEANING MACHINE

[1]Konkala Sowjanya, [2]Dr.K.Prahlada Rao
[1]PG Research scholar, [2]Professor
[1]Department of Mechanical Engineering,
[1]JNTUA College of Engineering, Anantapuramu, India,
[2]JNTUA College of Engineering, Anantapuramu, India.

Abstract : *In currently's scenario, RF Controlled Garbage Cleaners can be a big relief for this task of cleaning garbage from the places like beach. Here this system is a 4-wheel drive vehicle chassis equipped with a cleaning mechanism and a dirt bag for Garbage collection. The main aim of this system is to collect the waste and to reduce the plastic pollution.Two high performance electrical motor drives the vehicle chassis and one electrical motor drives the cleaning mechanism. Chain and sprocket based system transmits the power from the electrical motors to the wheels. The system is driven by a microcontroller powered circuitry PCB. Another PCB consists of directional push buttons used to transmit directional commands through rf. The receiver circuit receives these commands and the microprocessor processes these commands to drive the motors as well as the lifter mechanism motor accordingly. The lifter mechanism consists of a chain sprocket arrangement to drive the garbage lifter.*

IndexTerms - plastic pollution, shaft, fem and riovibro

I. INTRODUCTION

The "Beach Waste Collector" used in that places where there is waste debris in the water body which are to be removed. As the beaches plays a key role in fascination for the travel industry, visitors to the beaches are increasing day by day and the plastic waste around the beaches are also increasing which affects and huge impact to the aquatic life and environment of the world. Therefore the disposal of plastic waste is very necessary. The plastic accumulation leads to the plastic pollution. It will be huge impact mainly to the aquatic life and on environment (like soil, water, marine animals and birds etc). In recent studies found that million of tons of plastic in oceans are present in the world. Due to this plastic present in the ocean many millions of seashore animals are killed for every year.

The marine animals will consume their food along with the plastic materials. A s the plastic materials and their products will get mix with their food, so there will be change in the digestive physiology which leads to the death of the aquatic animals. Apart from this there are some daily usage practices of plastic like Grocery bags, cables, water and cool drink bottles, shampoo bottles, plumbing pipes, medicine bottles, food packaging etc.

There are some hazardous chemicals which release from the industries (like methane gas) damages the ground water and also the ecosystem. This will lead towards release of green house gases and global warming.

The plastic pollutants are divided into two such as Macro plastic which is largely visible >1mm and micro plastic <1mm. The plastic will be in the form of fragments, fibres, film, foam, pellet, bead, sheet etc. which cannot be decomposed known as Non- biodegradable waste products. The Non- biodegradable waste will remain for very long time in the environment and it cannot decompose easily. In the above figure we can see the biodegradable and non -biodegradable products. The peels of vegetables and fruits can decay easily when compared to plastic bags (10 to 20 years). To some extent we can reduce the plastic pollution by segregating the waste like Biodegradable waste, general waste, hazardous waste, and recyclable waste. If we throw the waste in a related trash bin,

The pollutants present in water can cause risky and illness. However long the depleting framework is viewed as the capacity of the primary waste framework is to gather, move and discard the water through an outfall or outlet. Pollutants in waste water can be just similar to discharge bottles, polythene sacks, papers, and so forth It's a Mechanical Working Model of Altogether Sunlight based Fueld Water Cleaning Instrument which Would auto be able to gather coasting trash and strong waste from the water surface and gather it into its skimming receptacle. It very well may be customized, scaled up to any estimate and can work distantly. The framework is indigenous and productive to track stream cleaning cause.

II. LITERATURE REVIEW

1] Ute S. Enderlein, ussRainer E. Enderlein and W. Peter William stated states that the production of toxic compounds should be banned because as they are very hazardous to life and there is a huge impact on aquatic life if those toxic compounds dissolve in the water

2]Y. Sharma;Dec (2011)"universal reverence to water" have expressed that, in numerous religions of the world water is utilized to praise the event which causes contamination of water. This is risky for sea-going carries on with a make the water uncommon. Because of which the idea of eliminating waste from water is shown up.

3] Haller 2009; Lembi 2009 used "management techniques for plants" This technique was used for some specific floating derbies and plans as well. There are constraints to the size of waste. Also, the improvement of the strategy is under restricting stage. No further improvement for this method is referenced

4] S. Veenstra, G.J. Alaerts and M. BijlsmaICWE in the International Conference on Water and the Environment in the year January 1992, have expressed that, in the recently industrializing urban communities' financial development is the essential factor of thought. More consideration on contamination conveying limit of climate is liked. Fundamental west water treatment plant moved 1m of west water in to 1-2lit of concentrated slop.

5] R.S.Khurmi A Textbook of Machine Design explains about machine design process and engineering materials with their properties and also manufacturing considerations in machine design

6] H. Larsen, N.H. Ipsen and L. Ulmgren completed extensive investigations on all aspects of water pollution. In many countries, one of the many reasons the major reason behind water pollution is use of fertilizers in agricultures. To make the country pollution free the principle instead implemented is “best environmental practice”.

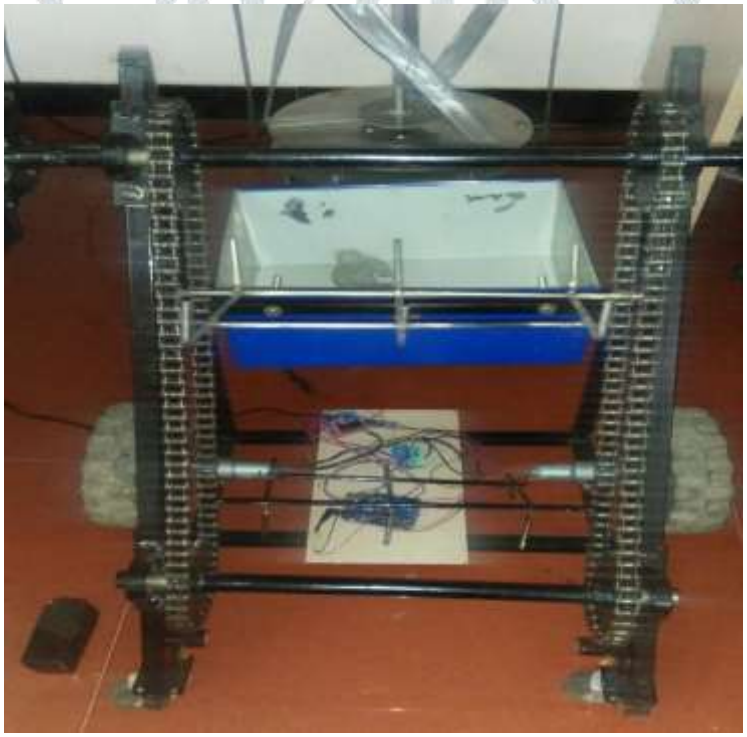
III. EXPERIMENTAL APPROACH

3.1 WORKING PRINCIPLE

In this project the main aim of this machine is to lift the waste debris from the sand surface and dispose them in the tray. The main Principle of the project is to collect the waste from the beach and to keep the environment safe and clean. The working of the project is as follows, the front wheels are castor wheels and the rare wheels are attached to the shaft rod. Sprocket -chain drive is continuously rotating with the help of motor so that it can pick the waste continuously. After picking the waste, it stores in a collecting bin which is attached to the chain drive. Once the power supply is given, the mechanism will get starts and the shaft will get rotate by kinetic energy. The Arduino board is the mother drive can control complete assembly procedure as it has RF transmitter and receiver. The propeller is run with the help of two PMDC motor. The total electrical device is controlled by RF transmitter and receiver which use to control the machine remotely.This system is a 4-wheel drive vehicle chassis equipped with a cleaning mechanism and a dirt bag for Garbage collection..

3.2 CONSTRUCTION

In this project, the fabrication is done by using the material mild steel. A Basic Frame is used as a structural body. It has for wheels for the movement of the project and the front two wheels are of castor wheel. Here three Johnson D.C Motor of 12V for rare wheels are used. For the conveyor moment a shaft rod of 14 mm was used. For bearing, metal bushes are used. The shaft is fixed to the chain-sprocket and gear. Top portion of shaft is connected to the DC Motor(12V). Power supply is given by the battery. The chain sprocket moves in vertical direction and a separate bin is attached to the shaft. This bin is used for the purpose of storing the waste. The assembly is done through Arc welding and by fixation of bolt/nut. The Arduino board is the mother drive can control complete assembly procedure.



IV. COMPONENTS AND SPECIFICATIONS

4.1 BASE FRAME

A frame is often a structural system that supports other components of a physically. Bed frame, the part of a bed used to position the mattress and base. A structural frame is used in this project which acts as a structural body of the project. And the type of material is Mild steel.

Specification-Length=620 mm,

Width=480 mm, Square Pipe of 2 mm thickness

4.2 HOLLOW PIPE

These are two hollow pipe joint together by permanent fastening with the help of M-seal. Specification Length=600mm, D1=600mm, D2=60mm.

4.3 SHAFT

A shaft is a rotating member, usually of circular cross section, used to transmit power or motion.
• It provides the axis of rotation, or oscillation, of elements such as gears, pulleys, flywheels, cranks, sprockets, and the like and controls the geometry of their motion.
• Carbon steels of grade 40C8, 45C8, 50C4, 50C12 are normally used as shaft materials.

Hollow shaft used to transmit the power with the help of belt drive. Hollow shafts are much lighter than solid shafts and can transmit same torque like solid shafts of the same dimensions. Moreover, less energy is necessary to acceleration and deceleration of hollow shafts. Therefore, hollow shafts have greater potential for use in power transmission in automotive industry. Specification- D1 =20mm D1 =18mm.

4.4 D.C MOTOR

A stepper motor is an electromechanical device which converts discrete electrical pulse into discrete mechanical movements. The shaft or spindle of a stepper motor rotate at equal angle of increment called steps when electrical command pulses are applied to it in the proper sequence. The sequence of the applied pulse is directly related to the direction of rotation of motor shaft and its speed directly related to the frequency of input pulses and total radiation at a stretch is directly related to the number of input pulse applied.

SPECIFICATION OF D.C MOTOR

- Length: 80mm
- Torque: 1.5 kg.cm
- Shaft Diameter: 6mm,
- Weight: 130.00g,
- Supply Voltage 12V
- Speed = 500 RPM

V. FEM APPROACH

FEA is a numerical FEA is a numerical technique, which gives nearly accurate solution to the difficult problems. It divides the complex structure into the finite number of the elements; this process is called as the discretization or meshing. This makes the makes the structure to be analysed in the easier way. Even the complex shaped structure and different engineering domain problem can be solved. Differential equation and integral equation are used as the mathematical models for representing the physical problems mathematically. Complex geometry and boundary condition of particular application makes the solution problem very difficult to solve by analytical method.in this case the finite element method come to our rescue for obtaining the solution by solving the governing equation.

While developing and designing a product, governing equations and fundamental formulas are used for analysing basic important components of the structure. To validate the results obtained, experimental testing is conducted for every engineering parameter. For extensive testing of product involves building a prototype which is expensive for a complex model, so use of FEM in analysis reduces considerable amount of time and capital for any design and manufacturer.

Finite element analysis (FEA) has ended up being typical place starting late, and is by and by the commence of a multibillion dollar for every year industry. Numerical responses for even especially complicated stress issues can now be gotten routinely

utilizing FEA, and the methodology is vital to the point that even right off the bat drugs of Mechanics of Materials {, for instance, these modules} should chart its essential elements.

The following steps are followed in finite element method.

- The principle used in the FEM is the discretization, where the whole structure is divided into finite sized elements of simple shape for ease of analysis.
- Variation of the displacement of the element is determined by polynomial shape function and nodal displacement.
- Relation between the stress-stain and strain displacement is advanced in terms of the unidentified nodal displacement.

The equilibrium condition is gathered in matrix shape, which is less demanding to program and illuminate in FEA software.

$$[K]\varphi = P$$

Where [K] is called assembled stiffness matrix,
Φ is called the vector of nodal displacement and
P is the vector or nodal force for the complete structure

- Appropriate boundary condition is applied.
- Solution of system equation to find nodal values of displacement.
- Computation of element strains and stresses.

5.1 GEOMETRIC MODEL

Fig 5.1, 3D FEM geometry model of Beach cleaning Machine

5.2 MESH GENERATION

In this analysis, mesh generation is auto mesh generation with element size is 20. This element size is used for all the body of Integral. The hex-dominant technique is used

Fig 5.2, 3D FEM meshing model of Beach cleaning machine

5.3 LOADING AND BOUNDARY CONDITIONS

Filling and boundary conditions essentially contain of two steps first is provision and second is applying loads. Following Figure Shows the Supports and Forces

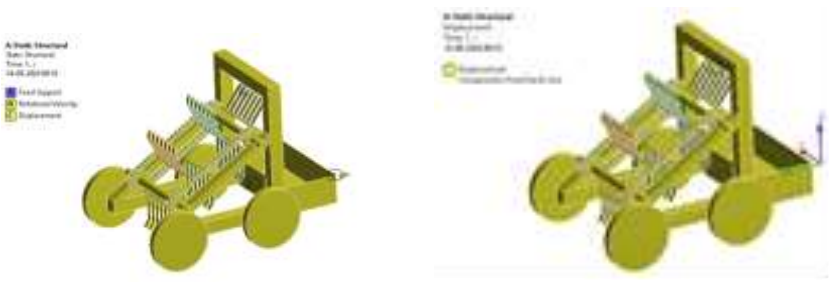


Fig 453, Rotational velocity is 1420 rpm and fixed support both the end

5.4 RESULT AND OBSERVATION

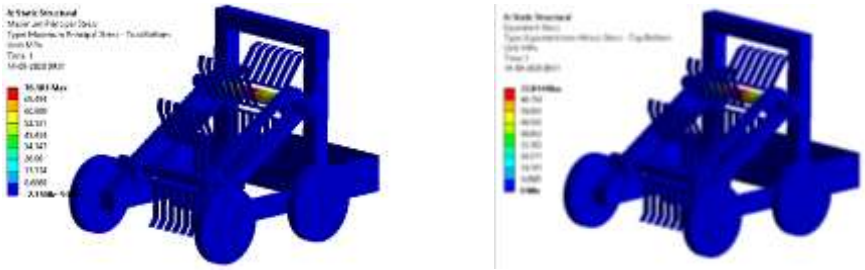


Fig 5.4, Max equivalent stress is 93.912 mpa for the applied load condition which is lesser then yield stress

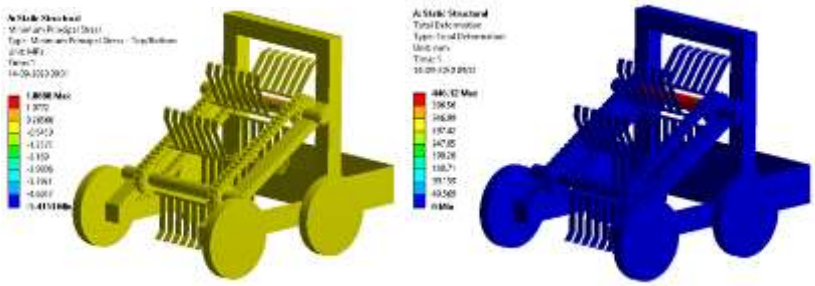


Fig 5.5, Max total deformation is 0.131 mm in horizontal view which is match with the excremental result of beach cleaning machine

VI. CONCLUSIONS

The following conclusions are drawn from this study. The shaft of the system is analysed on the basis of static loading. The stresses induced in the shaft are validated by FEA using ANSYS software. The Max.equivalent stress is 72.814mpa which is less than the yield stress 535mpa.Hence the component is in elastic limit that is in safe condition. This project is designed with the hope that it can decrease plastic pollution around the beaches along with the flexibility in operation and very much economical and helpful for beach cleaning.

VII. REFERENCES

1. M. Mohamed Idhris, M.Elamparthi,C. Manoj Kumar, Dr.N.Nithyavathy, Mr. K. Suganeswaran, Mr. S. Arunkumar, “Design and fabrication of remote controlled sewage cleaning Machine”, IJETT – Volume-45 Number2 -March 2017.
2. Pankaj Singh Sirohi, Rahul Dev, Shubham Gautam, Vinay Kumar Singh, Saroj Kumar,“Review on Advance River Cleaner”, IJIR Vol-3, Issue-4, 2017 ISSN: 2454-1362.
3. Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Pawitra, “AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model” International Journal of Future Computer and Communication, Vol. 3, No. 5, October 2014.
4. Basant Rai, “Polltution and Conservation of ganga river in modern India”, International Journal of Scientific and Research Publications, Volume 3, Issue 4, April 2013 1 ISSN 2250-315.
5. Emaad Mohamed H. Zahugi, Mohamed M. Shanta and T. V. Prasad,“Design Of Multi-Robot System For Cleaning Up Marine Oil Spill”, IJAIT Vol. 2, No.4, August 2012
6. Cary, Howard B; Helzer, Scott C.(2005).“Modern Welding Technology Upper Saddle River”, New Jersey: Pearson Education.
7. K. Manahawar, Mitali S. Mhatre, Review paper on Fabrication Of Manually Paper on Fabrication Of Manually Controlled Drainage Cleaning System”, IJSER, Volume 8, Issue 3, March-2017 ISSN 2229-5518.
8. Prof. N.G. Jogi, Akash Dambhare, Kundan Golekar, Akshay Giri, Shubham Take, “Efficient Lake Garbage Collector By Using Pedal Operated Boat”, IJRTER Volume 02, Issue 04; April 2016.
9. Dr. P.C.Sharma and Aggarwal, A text Book of Machine Design, Katson Publication,1996.
10. Robert Cook, Concept and Application of Finite Element Analysis , John Wiley , 1089.
11. P. Seshu, Text Book of Finite Element Analysis, Preentice- Hall India, 2004.
12. Kalpakjian, Serope; Steven R. Schmid (2001). “Manufacturing Engineering and Prentice Hall”. ISBN 0-201-36131-0.