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Review on Pipe Cleaning Robot

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ABSTRACT

We had researched and studied the pipe cleaning robot concepts and we had try to make some upgrades in it. As we know most sewage line gets overflow due to the hard materials stuck inside the pipes. It create blockage inside the pipes and reduces the flow of sewage water. For this operation of clearing the blockage of pipes different type's methods are used and sometimes blockage of pipes cannot be found under the ground. A man can only assume the blockage location but it is very hard to find the exact blockage location. Which increase man power and also waste of time in digging the roads. For simple and fast work we had design a robot which can perform cleaning as well as locating the blockage underground inside the pipes. The model we are building is for explaining how we can use a robot to clean pipes which consist of sludge's in inner layers of pipes and also to detect blockage inside the pipe line. This prototype model can also explain how we can use this robot to check the sewage pipe lines blockage and after detection we can apply the suitable operations to that section of the pipe only. This reduces the time and energy of workers which is wasted for digging the roads by an assumption of blockage underground.

Keyword: Pipe Cleaning Robot, sewage pipe lines.

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I. INTRODUCTION

The use of robots is more common today than ever before and it is no longer exclusively used by the heavy production industries the inspection of pipes may be relevant for improving security and efficiency in industrial plants. These specific operations as inspection, maintenance, cleaning etc. are expensive, thus the application of the robots appears to be less in use. Pipelines which are tools for transporting oils, gases and other fluids such as chemicals, have been employed as major utilities in a number of countries for long time. Recently, many troubles occur in pipelines, and most of them are caused by aging, corrosion, cracks, and mechanical damages from the third parties. Currently, the applications of robots for the maintenance of the pipeline utilities are considered as one of the most attractive solutions available should have high magnetic susceptibility and should be good conductor of electricity. The materials are copper and so on. But aluminum is chosen as the materials for the linkages and central body because of its much-desired properties. Pipe inspection is necessary to locate defects due to corrosion and wear while the pipe is transporting fluids. This ability is necessary especially when one should inspect an underground pipe. In this work, Pipe Inspection Robot (PIR) with ability to move inside horizontal and vertical pipes has been designed and fabricated. Inspection robots are used in many fields of industry. One application is monitoring the inside of the pipes and channels, recognizing and solving problems through the interior of pipes or channels. Automated inspection of the inner surface of a pipe can be achieved by a pipe cleaning robot. The materials used for this machine are light and rigid. Different materials can be used for different parts of the robot. For optimum use of power the materials used should be light and strong. Material should be ductile, less brittleness, malleable, and high magnetic susceptibility.

II. PROBLEM STATEMENT

- Now a day's many of industries used different diameter pipes for different application like to

carry chemicals, high pressure steam and gasess hence there may be chances of problems like corrosion, leakages.

- It is not possible to avoid all these problems manually.
- The conventional method is very difficult and tiring.

III. LITERATURE REVIEW

MA Wenqi, XIAO Zhiyong, ZHANG Meixia Numerical Simulation of Cavitation Washer in Pipe Cleaning Cavitation, Water jet can take advantage of the power generated from vacuole rupture to enhance the performance of the jet. Studies have shown that the pressure of the capitation jet is 8.6-124 times as high as continuous pressure in the same pump conditions; therefore the cavitation jet is widely utilized in cutting, cleaning and descalingss. The study focused on blade-type cavitation washer, using three-dimensional periodic modeling, combined with structured and unstructured grids, analyzed the two-phase Signal cavitation model in a finite volume CFD way. By taking turbulence intensity and non-condensable gas into account, the cleaning mechanism was analyzed and flow characteristics were gain. The results show that the cavitation effect mainly produced in two zones, the blade Tip area around the pipe wall and the double-blade staggered narrow gap. Throttling effect is the main cause of the cavitation effect. The cavitation number is used to evaluate the strength of the cavitation, and the cavitation number is between 0 and 0.5.

Yoon-Gu Kim1, Dong-Hwan Shin1, Jeon-Il Moon1, Jinung An1 : Design and Implementation of an Optimal In-pipe Navigation Mechanism for a Steel Pipe Cleaning Robot, This study focuses on the design and implementation of an optimal pipe navigation mechanism and a driving unit to overcome the variable situations inside steel pipes. It also offers adaptability to different pipe diameters. The important problems considered in the design and implementation are a self-sustaining property when in the center of a pipe, optimal navigation ability to adapt to in-pipe unevenness, the capability to remain stable without slipping in pipes, and the efficient operation of cleaning equipment. The robot developed here based, on carefully determined design specifications, was tested to verify the performance of its navigation mechanism and driving ability. In addition, a control system was developed for the test. The ultimate goal is the application of the verified in-pipe cleaning robot to industrial and practical applications.

Andrei ȘTEOPAN, Mihai STEOPAN & Andrei NICU: Competitive Design and Mockup of a Modular Pipe Cleaning Mobile Equipment, Designing application oriented products require dedicated approaches. One possible approach is the use of competitive design tools and techniques in the conceptualization phase of the product. In this paper the authors present the development process for a mobile platform meant for cleaning / maintenance operations of flatbed ventilation tubing. Special attention was given to the main 2 mechanical modules: the motion module and the ventilation module.

José Saenz, Fraunhofer IFF, Norbert Elkmann, FraunhoferIFF, Thomas Stuerze, Fraunhofer IFF, Sven Kutzner,Fraunhofer IFF and Heiko Althoff: Robotic systems for cleaning and inspection of large concrete pipes, Concrete pipes are used in a variety of areas for conducting media underground (e.g. wastewater, cooling water,etc.) or for transportation purposes. Regular cleaning and inspection is required to ensure the static integrity of the pipe And to insure against the problems associated with failure of the pipe. In this paper, the SVM-RS system for cleaning and inspecting large concrete pipes will be presented. Various aspects of the robot including its kinematics, the cleaning system, the sensor system, the media supply, communications, as well as the control system and operator interface will be discussed in detail. The use of robust robotics for accurate positioning of high-pressure water Nozzles in combination with non-destructive sensing techniques for navigation and inspection during normal pipe operation allows for a new standard in high-quality pipe cleaning and inspection. The latest cleaning and inspection results from tests in real sewers will be presented.

IV. METHODOLOGY

Methodology used for whole processing of Robot is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

- Prepare Research Paper
- Collection of Data
- Numerical Calculation for Arrangement
- Design Calculation Of arrangement of Components
- Develop Prototype of model
- Testing and Analysis
- Final Result
- Conclusion

V. DESIGN

Design consists of application of scientific principle, technical information, and imagination for development of new mechanism to perform specific function with maximum economy and efficiency. Hence careful design approach has to be adopted. The total design work has been split into two parts.

1. System design
2. Mechanical design

SYSTEM DESIGN:

System design is mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on frame at system, man-machine interaction, no. of controls, position of controls, working environments, of maintenance, scope of improvement, weight if machine from ground level, total weight of machine and a lot more. In system design we mainly concentrated on the following parameter:-

- System selection based on constraints

Our machine is used in small-scale so space is major constrain. The system is to be very compact so that it can be adjusted in small space.

- Arrangement of various components

Keeping into view the space restrictions all components should be laid such that their easy removal or servicing is possible. Every possible space is utilized in component arrangements.

- Man machine interaction

Friendliness of machine with the operated that is operating is an important criterion of design.

- Chances of failure

Losses incurred by owner in case of any failure are important criterion of design. Factor of safety while doing design should be kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

- Servicing facility

Layout of components should be such that easy servicing is possible. Those which require frequent servicing can be easily disassembled.

- Scope of future improvement

Arrangement should be provided in such way that if any changes have to be done for future scope for improving efficiency of machine.

- Height of machine elements from ground

All the elements of the machine should be arranged to the height from where it is simple to operate by operator. Machine should be slightly higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

- Weight of machine

Total weight depends on the selection of material of all components as well as their dimensions. Higher weight will result in difficulty in transportation; it is difficult to take it to workshop because of more weight.

MECHANICAL DESIGN:

In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely.

1. Designed parts
2. Parts to be purchased

Mechanical design phase are very important from the view of designer as whole success of project depends on the correct design analysis of the problem.

Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge about physical properties of material, load stresses and failure. He should identify all internal and external forces acting on machine parts. These forces may be classified as,

a) Dead weight forces
b) Friction forces
c) Inertia forces
d) Centrifugal forces
e) Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side. Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, shape of parts & service requirements Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material provision should be made to minimize nearly adopting proper lubrications method.

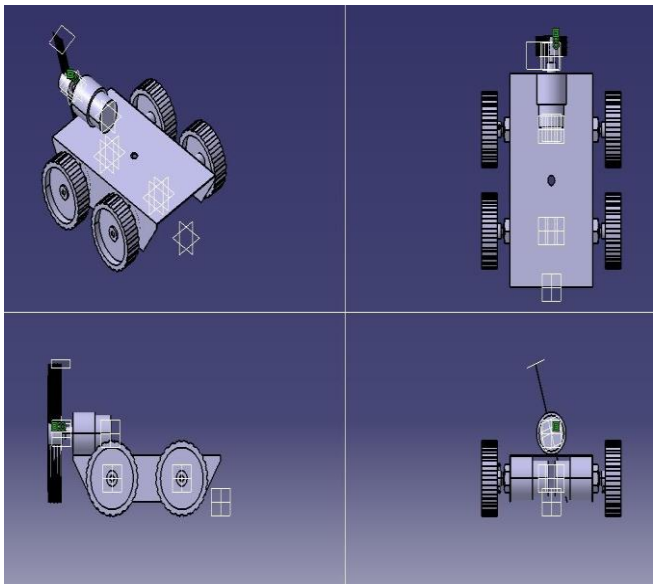

Fig No 1: Isometric View

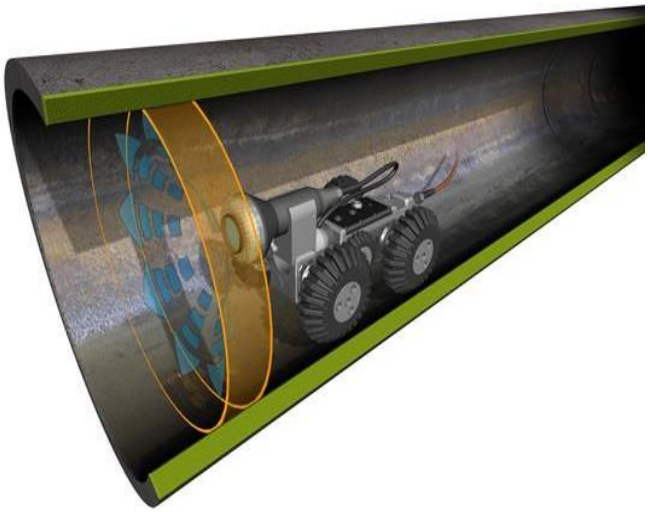

Figure no 2. view of ultra-sonic sensor work

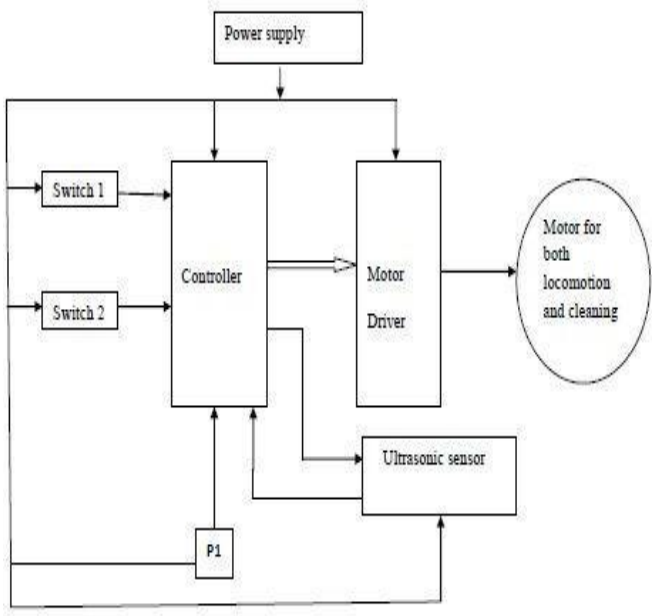

Figure no. 3. Control circuit

VI. CONCLUSION

This project is successfully designed, implemented and tested. The main function for this project was achieved. Everything that we learned was applied in this final year project. Students can improve the skills to make mechanical and electronic designs that very useful after graduate and in working life after that. Robot development, it is hoped that this robot can be reconstructed with some modification to improve the abilities and to provide benefits in future also be able to be marketed or commercialized.

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