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Title: Proposal of Cable Based Sewer Cleaning Robot for Carrying Garbage out of the Sewer Pipe

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Abstract

Statement of the Problem: The accumulation of garbage inside the sewerage system leads to the serious flood problem which makes bad affect to human life. Currently, although many sewer inspection robots are available and a lot of studies in in-pipe robot were conducted; for cleaning the sewerage system, the most efficient way is that the workers enter into the sewer pipe to perform tasks. Sewerage system is extremely hazardous and dirty environment which contains germs, diseases, insects, snakes, centipedes, mud, animal bodies, needles, clothes, bulbs, poisonous chemicals, … that are harmful to human. This problem leads us to the idea to research and develop a sewer cleaning system called Cable Based Sewer Cleaning Robot (CBSCR) for replacing human labors inside the sewerage system. Methodology & Theoretical Orientation: CBSCR is developed by combining a mobile robot that performs the task of collecting garbage with a garbage transporting system that performs the task of carrying garbage onto the ground as shown in Fig. 1. The mobile robot is equipped with a manipulator for removing garbage out of the sewer pipe surface and a garbage collecting system for gathering garbage into bags for easier to move onto the ground. In the other hand, the garbage transporting system is based on a wire mechanism module called Double Actuator Module (DAM) which was proposed in [1, 5]. This system includes one DAM that contains two winches put on a frame arranged on top of the manhole and connect to the mobile robot through two pulleys. Two motions produced by DAM are used in the transporting system; where one is used for adapting the cable length with respect to the location of the mobile robot inside the sewer pipe and the other is used for transporting the garbage bags out of the sewerage system as shown in Fig. 2. Findings: CBSCR is proposed as a solution for removing human labors from the dangerous and harmful tasks inside the sewerage system. The mobile robot will access into the sewerage system, collect and package garbage into bags. Then by utilizing the ability to transport load through long distance of cable system, the transporting system based on cable will carry garbage out of the sewer pipe without any requirement of human labor inside this hazardous area. Conclusion & Significance: The idea presented in this abstract is an efficient way for removing human from the dangerous tasks in the inaccessible areas. Further studies could be: apply this idea to develop the Tunnel Boring Machine (TBM); equip the robot with an IOT system for monitoring the toxic gases inside the sewerage system; develop a robot control system that uses computer vision as an AI system for the robot.

Image (If Any)

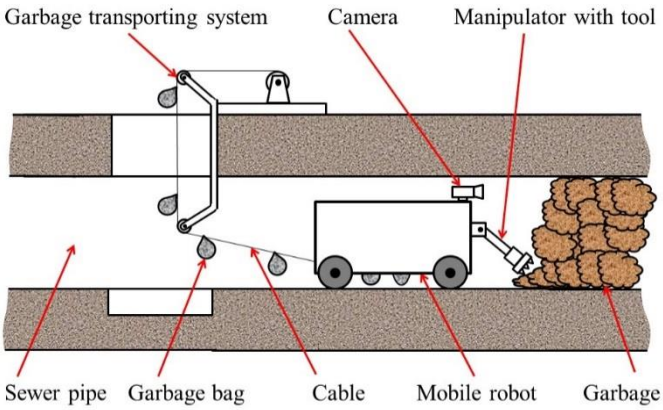


Figure 1: Working principle of CBSCR.

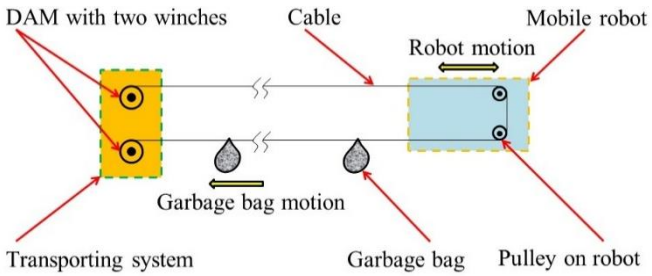


Figure 2: Working principle of the garbage transporting system based on cable.

Recent Publications (If Any)

1. T. Le Nhat, H. Dobashi and K. Nagai (2016) Configuration of Redundant Drive Wire Mechanism Using Double Actuator Modules. ROBOMECH Journal, Springer Open publisher, 3_25: 1-16.
2. T. Le Nhat, H. Dobashi and K. Nagai (2016) Kinematical and Static Force Analysis on Redundant Drive Wire Mechanism with Velocity Constraint Modules to Reduce the Number of Actuators. ROBOMECH Journal, Springer Open publisher, 3_22: 1-22.
3. T. Le Nhat, H. Dobashi and K. Nagai (2014) Design of Vibration Suppression Mechanism in Two Wires Drive Mechanism for Producing High Acceleration and High Precision motions. Robotics Society of Japan.
4. K. Nagai, T. Le Nhat, Y. Hayashi and K. Ito (2012) Kinematical Analysis of Redundant Drive Wire Mechanisms with Velocity Constraint. ICMA, 1496-1501.
5. K. Nagai, T. Le Nhat, Y. Hayashi and K. Ito (2011) Proposal of Redundant Drive Wire Mechanism for Producing Motions with High Acceleration and High Precision. SII, 1049-1054.



Biography (150 word limit)

Le Nhat Tam obtained his Bachelor and Master degrees from the Automotive Engineering Division of the Transportation Engineering Faculty at Ho Chi Minh City University of Technology, Vietnam in 2007 and in 2009. He had worked as an engineer at Isuzu Vietnam Company from 2008 to 2010. He earned his PhD from the Department of Robotics of the Faculty of Mechanical Engineering at the School of Science & Engineering, Ritsumeikan University, Japan in 2017. From 2017 till now, he is joining in the Precise Mechanic and Automation Division at an R & D Center called SHTP labs in Ho Chi Minh City, Vietnam. His research interests include developing of mechanical system, automatic control system, wire mechanism and service robot. His current focus of research is developing a sewer cleaning robot for cleaning the sewerage system to reduce the flood problem in Ho Chi Minh City.

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