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BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF MINING & WATER RESOURCES ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

A FINAL YEAR PROJECT REPORT

Design and Simulation of a Sewer Blockage Detection System.

(A Case of NWSC-Mbale Area)

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EXECUTIVE SUMMARY

Sewer blockages in waste-water sewer systems is a serious problem for many cities and a challenge to the organizations responsible for sewer systems. Most sewer systems, a large percentage of the waste-water is lost in transit from treatment plants to consumers. Water loss can be attributed to several causes, including leakages, metering errors, public usage such as fire-fighting and pipe flushing, and theft. Leakage is usually the major cause.

This project analyzes and reviews the existing leak detection systems, types of pipes, categories of pipes and analyzes and inspects the likely causes of leakages and bursts in pipes for example Corrosion of internal and external surfaces of pipe network, excessive load/stresses from road traffic, excessive water pressure, water hammer, too old pipes, poor design and mechanical damage.

The research involved analyzing data for the sewer line blockage detection system, relevant technologies that were used to design, simulate and validate the system. The research data collection methods included desk study, consultation, reconnaissance and document review. These were carried out with NWSC officials and the community members from different parts of the municipality so as to understand the likely causes of the blockages in the sewer system, how efficiently they were able to determine the blockages and how fast the blocked sewer systems were unblocked. This information helped come up with the relevant requirements for the system and the technical information involved in waste-water transportation through conduits so as to come up with a viable system.

The system design depended on the characterization of the parameters which among which included differences in discharge and differences in head. Bernoulli's equation was used as the governing equation from which other formulae were derived for the distance to the point of the blockage. The system was divided into three major categories that was the input unit, processing unit and the output unit which was the display unit.

The system was simulated using HEC-RAS which was acting as the natural environment which data was input into MATLAB which as the micro-controller. The display of the results at the field was done by the FIELDGUI and office computer GUI acted as the display to the office computer. The folder linking the fieldGUI and office computer GUI acted as the GSM.

The recommendation is that National Water and Sewerage Corporation should adopt this system to overcome the manual ways currently used.

ACKNOWLEDGEMENT.

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I real thank my family for the continued support they have given to this level for the financial support, guidance and encouragement towards my education and upbringing.

All in all I thank the Almighty God for the gift of life and for being there for me.

DECLARATION.

I WANANDA SAM, declare that all the material portrayed in this project proposal report is original and has never been submitted in for award of any Degree, certificate, or diploma to any university or institution.

Signature


.....



Date

02/06/2016
.....

APPROVAL.

This is to certify that the project proposal has been carried out under my supervision and this report is ready for submission to the Board of examiners and senate of Busitema University with my approval.

MAIN SUPERVISOR: Mr. MARTIN SSEMBATYA

SIGNATURE:

DATE:

CO-SUPERVISOR: Ms. ENGOLE MARION

SIGNATURE:

DATE:

LIST OF ACRONYMS.

AUVs	Autonomous Underwater Vehicles
BPN	Back-Propagation Neural network
CCTV	China Central Television
CCD	Charge Coupled Device
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EPA	Environment Protection Agency
EV	Eco-vehicle
FBs	Foreign Bodies
FOG	Fat Oil and Grease
GPR	Ground Penetrating Radar
GPS	Geographical Positioning System
GSM/GPRS	Global System for Mobile / General Packet Radio Services
HPIS	Hemispherical Panoramic Imaging System.
LLL	Lambda Locked Loop
MATLAB	Mathematics Laboratory
MHz	Mega Hertz
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NDT	Non Destructive Testing
NWSC	National Water and Sewerage Corporation
PSA	Pulse Signaling Algorithm
RBN	Radial Basic Network

SIUPRPR	Single Immersion Ultrasonic Probe joined with a Rotating Planar Reflector,	vi
SSOs	Sanitary Sewer Overflows	
SVM	Support Vector Machine	
TDBP	Time-Domain Back Projection algorithm	
TV	Television	
UWB	Ultra Wide Band	

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1 CHAPTER ONE: INTRODUCTION

1.1 Background of study

Sewers are underground conduits for carrying off drainage water and waste matter.

Drainage and sewerage have always been part of the essential infrastructure of a modern city.

Sewer blockages pose several problems to the functionality of the drainage system. This can include the loss of wastewater cleaning facilities which are unable to discharge into the sewer.

The prevention of wastewater removal because of a blockage can result in emission of foul odours from surcharged manholes and yard gullies. The continued hydraulic loading of a blocked sewer can result in the escape of sewage from manholes, inspection chambers or yard gullies and cause external flooding. This may result in contamination of garden or road areas which will require cleaning and disinfection following the event. External flooding can also result in pollution of natural watercourses if an adequate pathway for sewage ingress into a watercourse exists. (Trefor Hillas Exeter University June 2014). These blockages make it expensive for maintenance since the installed pipes have to be punched so as to remove the blockages and with time the punched areas have to be replaced with new pipes. (Senior Eng. NWSC-Mbale).

Fat Oil and Grease (FOG) deposits in sewer pipes have been shown to be insoluble metallic salts of fatty acids and may lead to SSOs that impose a risk to public health and the environment by releasing high concentrations of pathogens, nutrients, and solids (He et al., 2013). About fifty percent of SSOs are due to line blockages, where half of these blockages are caused by FOG deposits (EPA, 2004). According to EPA, about 3-10 billion gallons of untreated wastewater is discharged annually as a result of Sanitary Sewer Overflows (SSOs). Consequently, maintenance of the pipes and frequent cleaning activities become crucial to achieve a high level of wastewater conveyance by the sewer collection system. The buildup of blockages on the inside of a pipe wall often begins in the form of increased roughness with small amplitude, grows with time and can eventually block a sizeable portion of the pipe's cross sectional area. Such blockages result in wastage of energy and financial resources, reduction in carrying capacity, increased potential for contamination, (moez louati(1) & mohamed s. ghidaoui 2015). In most cases NWSC identifies these blockages when they are reported by the people and this indicates that the accumulation of these materials has been going on for a while. These are worked on but in most

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