FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES AND MINING ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN AND CONSTRRUCTION OF AN IMPROVED MOTORIZED SEWAGE SUCKER MACHINE FOR EMPTYING FILLED MANHOLES

BY

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ABSTRACT

Referring to the informal settlements within Bwaise III zone, central Kampala City, pit latrines are the most common and cost-effective onsite sanitation facilities. However, the lack of effective technological options poses challenges when latrines get full. Vacuum tankers currently influence the market but focus on emptying septic tanks in the most accessible areas only, rather than hard to reach areas where pit latrines and filled manholes reign. Alternative emptying technologies, such as the Gulper Pump and Diaphragm Pump, have had limited success in filling the technological gap. Hence, households in informal settlements within Bwaise essentially rely on manual pit emptying involving shoveling by hand and digging new pit latrine. These practices correlate with health risks and dreadful space limitations. An emptying machine must be sustainable, which means it must be able to be fixed locally, and quickly. This study assessed the redesign, construction, and evaluation of a multi-piston pump for emptying filled pits. The design adopted was a motorized emptying technology that was constructed from recycled materials and locally available materials like motorcycle wheels, scrap metals, rubber, and plastics. Based on the uncovering during testing, the motorized sewage sucker machine is a prospective pit latrine emptying machine in Bwaise slum. However, the developed motorized sewage sucker is not yet as optimized as globally available pit latrine emptying technological options. Hence further alterations are recommended based on current design constraint.

DECLARATION

I **OPIO INNOCENT**, 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 of higher learning.

Signature

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Date

…………………………..

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I would like to extend my sincere thanks to the almighty God who has gifted me with life and has enabled me to reach this academic height as he has been the provider of all the requirements.

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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.

SUPERVISOR:

MR. MASERUKA BENDICTO

SIGNATURE: ……………………………………

DATE: …………/…………………/………………

LIST OF ACRONYMS AND ABBREVIATIONS

table 1: List of abbreviations

Acronyms	Meaning
FS	Fecal sludge
FSM	Fecal sludge management
SSM	Sewage sucker machine
KCCA	Kampala City Council Authority
MDG	Millennium Development Goals
SDGs	Sustainable Development Goals
UN	United Nations
UNHSP	United Nations Human settlements program
WHO	World Health Organisation
WSP	Water Sanitation Program
USD	United States Dollars
O&M	Operation and Maintenance
PVC	Polyvinyl chloride
HDPE	High-density polyethylene

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CHAPTER ONE:

1.0 INTRODUCTION

Preamble

This chapter describes the general information relevant to the research while clearly showing the problem of interest for the intended design. It includes how this study will help reduce the problem through the fulfillment of some objectives listed therein.

1.1 Background of Study

One of the biggest challenges facing urban settings is Fecal Sludge Management (FSM) where pit latrines fill faster than available capacities to empty and safely treat or reuse the resulting sludge. 4 billion (10^9) people produce sanitary waste, 60% of waste is discharged to the environment without treatment (al B. e., 2013) and 80% of Kampala's households depend on sanitary services (Rossi, 2016) (Coombes, 20212)

UN defined the MDGs target of goal 7 of halving the proportion of the population without access to improved sanitation facilities in response to the lack of access to basic FSM facilities, (United Nations, 2015). Onsite sanitation technologies like flush toilets connected to septic tanks, pit latrines serve around 2.7 billion people. (Strande, 2014). UNDP and UN-Habitat estimated that 90% of the waste generated is discharged to the environment untreated. Many developing countries discharge the bulk of domestic and industrial wastewater without treatment or only after primary treatment.

Sub-Saharan Africa experiences deficient access to bettered sanitation facilities. Desk study carried out by the Water and Sanitation Program (WSP) of the World Bank indicated that Uganda loses about USD 177 million per year due to substandard sanitation resulting from below par waste management. Poor sanitation and hygiene are attributed to premature death from health-related diseases (Harada, 2013), The elevated population in Kampala City (1.5 million inhabitants) causes deficient access to FSM facilities, a lofty urbanization rate (about 5%) translating into an expansion of informal settlements (over 60%). An estimated percentage of Over 90% use pit latrines of inadequate standards. Those

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