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FINAL YEAR PROJECT REPORT

A REMOTE-CONTROLLED FIREFIGHTING ROBOT.

BY

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May the almighty GOD bless you richly and exceedingly!

Thanks.

DECLARATION

I, BUYI NICHOLAS JUNIOR do hereby declare that this Project Report is original and has not been submitted for any other degree award to any other University before.

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APPROVAL

This Dissertation Report under the title “A REMOTE-CONTROLLED FIREFIGTING ROBOT” has been submitted with the approval of the following supervisor.

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DEDICATION

I dedicate this project report to my lovely Dad Mr. Buyi Stevens Mungoma and Mum, Mrs. Khanzira Allen Buyi.

I am very grateful for the support and endeavors you have done for me throughout my entire academic journey. May the Almighty richly reward you.

LIST OF ACRONYMS AND ABBREVIATIONS

AVR: Automatic Voltage Regulator

CERT: Company Emergency Response Team

CO_2: Carbon dioxide

DFD: Data flow diagrams

LED: Light Emitting Diode

NFEC: National Fire and Civil Emergency Preparedness Council

PCB: Printed Circuit Board

RF: Radio Frequency

T/C: Thermocouple

UHF: Ultra-High Frequency

VHF: Very High Frequency

ABSTRACT

There are many possibilities a fire can start in an industry or in any remote area. For example, in cotton mills, garments, fuel storages, etc., electric leakages can lead to huge damage. Also, it's a worst-case scenario, causing heavy losses not only financially but also destroying areas surrounding it. Robotics is the emerging solution to protect human lives and their wealth and surroundings.

This project consists of a robot made up of servo and DC motor with an Atmel chip the 8-bit ATMega328PU microcontroller in 28 pin DIP packages, water pump and tank and a temperature sensor to protect the robot from high temperatures that can cause it to burn and an RF remote to control the robot having an HD44870 character-based LCD- JHD162A to make it easy for the user to monitor and control the robot.

The over roll goal of this project is to prevent the fire fighters and people from the problem of fighting fire from close range using methods like fire extinguishers. Fighting fire from a safe distance saves people from risks like getting burnt and high temperature near the fire and also people who fear to fight fire from a close distance can use this robot by controlling it using a remote from a safe distance.

The work is arranged mainly in six chapters, Chapter one includes the introduction of a firefighting robot. Chapter two discusses the literature related to the system, Chapter three illustrates the methodologies used in coming up with the working prototype of the system, Chapter four includes system design and analysis, Chapter five contains the implementation and testing of the system and chapter six contains the summary of the work, discussions and recommendations.

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CHAPTER ONE
INTRODUCTION.

1.1 Background of the Study

There have been numerous media reports on fires in Uganda in different institutions and places. Every year there are always cases of fire that occur in Uganda or to people around. Though it's terrifying, but there is always someone who would come and rescue in anytime, ready to sacrifice and risk his or her life in order to help the needy, Fire Fighter. Fire-fighting is an important but dangerous occupation. A fire-fighter must be able to get to a fire quickly and safely extinguish the fire, preventing further damage and reduce fatalities. With the development in the field of robotics, human intrusion has become less and robots are being widely used for safety purposes. In our day-to-day life, fire accidents have become common and sometimes may lead to hazards that make it hard for the firemen to protect human life [1].

According to the 2013 Uganda police report, a total of 936 Fire emergency calls were received out of which 702 were actual calls handled, 173 incidents of fire emergency calls were handled before the arrival of Fire brigade and 61 false calls were responded to. Most of the fires were registered at Kampala Headquarters (562), followed by Rwizi (84), Kiira (47), Elgon (37) and Masaka (33) among other fire stations [2].

The number of people injured in the fire incidents increased from 28 in 2012 to 56 in 2013 while those who died in the incidents increased from 22 in 2012 to 62 in 2013. Residential structures continue to have the biggest number of fires over 34 %, followed by commercial structures at 16% among others[3]. Electrical short circuits remain the single most identified cause of fire out breaks in Uganda due to habits like overloading power supplies, poor wiring, using poor quality electrical materials, structures not protected from power upsurges and fluctuations along with outright theft of power. Candles and Charcoal stove increased significantly from 90 cases in 2012 to 194 cases in 2013[4].

The commonest method of stopping fire currently is by using the fire extinguishers and common types of fire extinguishers include the Water, AFF Form, Dry Powder, Carbon Dioxide and wet chemical fire extinguishers. Water fire Extinguishers are good for tackling Class A fires involving burning wood, paper, textiles and general combustible material. AFF form extinguishers are suitable for class B flammable liquid fires such as paint and paint, it is also effective for class A fires such as man-made furnishings. ABC Dry powder fire extinguishers are a multi-purpose

and highly effective extinguishing agent, making them an excellent choice for use in many circumstances. They are ideal for use in warehouse and factory environments and other areas where the considerable advantages offered by their effectiveness and multi-purpose application outweigh the advantage of their residual properties. As their extinguishing medium is dry they will not cause damage to items such as documentation in the way that wet types such as wet types such as form do. Carbon Dioxide (CO_2) fire extinguishers are safe for use on electrical appliances and are non- residual, making them ideal for use in office environments where sensitive computer equipment would be damaged by bother types. Wet chemical fire extinguishers are specially designed for class F fires in kitchens involving burning cooking oils and fats like deep fat fryers[5].

Currently in case of outbreak of fires, one has to manually carry the extinguisher and move close to the fire area in order to stop the fire which puts their life at risk as some burning things may even be explosives and also the temperatures near the fire area are too high due to too much heat generated by the fire. Fire extinguishers are also heavy and difficult to use for some people[6]. The above methods of firefighting are complex and risky to use while fighting fire outbreak. A remote-controlled firefighting robot allows a user to control a fire fighter robot equipped with water tank and gun remotely and wirelessly for extinguishing fires.

1.2 Problem statement.

Fire out breaks are on a high increase in Uganda leading to loss of a lot of property and people's lives at large. They are due to lack of simple and easy methods that people can use to put off fire at its initial stage of outbreak. The fire extinguishers are not user friendly to the users and also risky as the user has to be close to the fire which puts the life of one at risk and young people cannot manage the operation of the extinguishers due to their weight and functionality. This method of firefighting where the person needs to be close to the fire needs to be improved to eliminate users from risks of fighting fire from a close range. Therefore, a remote-controlled firefighting robot which enables anybody available to put off the fire by controlling the robot using the RF remote which operates up to a distance of 100 meters has been developed.

1.3 Objectives.

1.3.1 General objective.

To design and develop a remote-controlled firefighting robot system.

1.3.2 Specific objectives.

1. To review existing literature and identify the requirements for the development of a remote-controlled firefighting robot. This will involve the study of existing systems and their weakness so as to come up with a better system to solve fire problems.
2. To design a remote-controlled firefighting robot. Here the architecture design will be made so as to start its development.
3. To develop a remote-controlled firefighting robot. The real system will now be developed for the functionality ready to be tested.
4. To test and validate the system. The developed system which is ready will now be tested for its functionality and then validated.

1.4 Justification.

There are many possibilities a fire can start in an industry or in any remote area. For example, in cotton mills, garments, fuel storages, etc., electric leakages can lead to huge damage. Also, it's a worst-case scenario, causing heavy losses not only financially but also destroying areas surrounding it. Robotics is the emerging solution to protect human lives and their wealth[7].

A robot capable of fighting a simulated household fire has been developed. It is able to autonomously navigate through a modelled floor plan to actively put off the flame. The robot can even act as a path guider in normal case and as a fire extinguisher in emergency. Robots designed to fight a fire, before it rages out of control, can one day work with fire-fighters greatly reducing the risk of injury to victims and firefighters.

1.5 Scope

The system is wireless, based on RF technology which is only able to detect signal from its remote and then activate the pump to spray the water in order to stop the fire.

The system will suitable for class A fires.

1.6 Challenges

The biggest challenge was the importation of components which could take time to be shipped and shipping could take time like a servo motor which took one month.

Another challenge was that some components bought where not compatible with others on the system. For example, the motor drive MC33926 I got was not able to run my DC motor which needed high current up to 2V and this could end on 1V so I hard to get an MD10A which uses current up to 5V.

Software like proteus ISIS are trial versions which are not stable.

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