Sudan University of Science and Technology
College of Engineering
Electronics Engineering School

Design Control Circuit of Robot Arm to Detect and Collect Iron metal

تصميم دائرة تحكم لزراع آلي يكتشف و يجمع معدن الحديد

A Research Submitted In Partial fulfillment for the Requirements of the Degree of B.Sc. (Honors) in Electronics Engineering

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الاستهلال

بسم الله الرحمن الرحيم

صدق الله العظيم

سورة العلق

الاية (1-2)

Dedication

To the candle of my life (Mama)

To my father & brother

To my teachers,,,,

To my colleges and friends,,,,

To Those who are searching

Knowledge,,,,

I dedicate this work….

Acknowledgement

In the Name of Allah, the Most Merciful, the Most Compassionate Praise Be to Allah, the Lord of the worlds; and prayers and peace be upon Mohamed His servant and messenger.

Then many thanks and appreciations are extended to **my supervisor A. Musab Mohammed Salih** for his valuable advice and endless effort to make this work come into reality. And lot of thanks to my teacher **A. Hashim Batran** for his opinions, guiding and supporting in this work.

Abstract

Robots arm are used for the most boring and repetitive jobs in manufacturing. Also they are used in dangerous and unpleasant jobs such as sorting and recycling wastes. So, in this research arobotic arm with three degree of freedom was designed to detect and collect the iron particles from different wastes. It was simulated with Proteus Virtual System Modeling (VSM) software, then built and tested. The model consists of a 3 servomotors which are controlled by an Atmega-16L microcontroller programmed via BASCOM-AVR software. In this model the waste will be fed to the conveyor belt while it's moving. The metal Sensors which are clamped below the conveyor belt, will sense the iron particles and in stop the conveyor belt. A robotic arm to which an electromagnet is attached will extract the iron particles from the waste and will deposit it into a box. The other wastes will be carried on further once the iron particles are extracted and dumped into a waste box.

المستخلص

تستخدم اذرع الانسان الالي في معظم الوظائف المملة و المتكررة في التصنيع . كذلك يتم استخدام هذه الاذرع في الوظائف الخطرة و الغير مريحة للانسان مثل فرز واعادة تدوير النفايات . في هذا البحث ، صمم ذراع حرالحركة يكتشف و يجمع القطع الحديدية من بين النفايات المختلفة . حيث تمت نمذجت الذراع باستخدام حزمة بروتوز ثم بناءه و اختباره . يتكون النموذج من ثلاث محركات يتم التحكم بهم باستخدام متحكم دقيق نوع Atmega-16L تمت برمجته باستخدام البرنامج BASCOM-AVR. في هذا النموذج توضع النفايات على الحزام الناقل اثناء حركته ، و ثبت حساس للمعادن على الحزام الناقل لتحسس القطع الحديدية و اعطاء اشارة لايقاف الحزام الناقل . و بواسطة الموجات الكهرومغنطيسية المتكونة عند مؤثر النهاية المغناطيسي يتمكن الذراع من التقاط القطع الحديدية و وضعها داخل الصندوق المخصص لها.

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Abbreviations

D O F : Degree of freedom.

OL : Open Loop control system.

CL : Close Loop control system.

SCARA : Selected Compliant Articulated Robot Arm.

PTP : Point to Point motion.

CP : Continuous Path motion.

MCU : Microcontroller Unit.

RAM : Random Access Memory.

ROM : Read Only Memory.

SFR : Special Function Registers.

PWM : Pulse Width Modulation.

CNC : Computerized Numerical Control machines.

EMF : Electromotive Force.

ALU : Arithmetic Logic Unit.

RISC : Reduced Instruction Set Computer.

CISC : Complex Instruction Set Computer.

CHAPTER ONE

INTRODUCTION

1.1 Preface

Robotics is the engineering science and technology of robots, and their design, manufacture, application, and structural disposition. Robotics is related to electronics, mechanics, and software [1].Robots are electro-mechanical machines that collect the information about the environment using some sensors and makes a decision automatically [2]. They are widely used for variety of task such as service stations, cleaning drains and in tasks that are considered too dangerous to be performed by humans like sorting waste [1].

Sorting waste and recycling are effective ways of reducing dumped trash. Unfortunately, these practices are not widely implemented so that people throwing recyclables that can still be reused [3].

1.2 Problem Statement

In many countries recycling centers do manual process of sorting wastes which make people doing unpleasant tasks and expose them to high risk diseases.Also the results of this process may be incorrect, inefficient with wasting in money and time.

1.3 Proposed Solution

This project is proposed to solute part of the huge problem by using robot arm to sorting iron metal particles from the industrial and municipal wastes. This will improve the control of sorting waste systems to give results in energy savings, safety improvements,minimizes raw metals wastage, reduces manufacturing costs and better environmental performance.

1.4Research Aims and Objectives

This project aims to design robot arm for making good detecting and collecting of the iron metal particles from different wastes.

The main objectives of this project are:

- Design control circuit for the model by using microcontroller.
- Simulation the control circuit by using Proteus (VSM) software.
- Implement prototype hardware in a real time environment.
- Performance evaluation of the proposed model.

1.5 Methodology

This model will be built by using: three servo motors, metal sensor, microcontroller (ATmega16L), DC motor, driver (ULN2803), driver (L293D) and magnetic gripper.

When the microcontroller will be initialized the DC motor will start work so that the conveyor belt will run. However, the waste will be fed to the conveyor belt the DC motor will still be working only if the metal sensor sense an iron metal particle in the waste. When that happen there will be a high digital response signal will be sent from the metal sensor to the microcontroller.

Accordingly, the DC motor will stop immediately and the microcontroller will start sending a sequence of signals to three servo motors one after another to move the robot arm for pick the iron particle then put it in the box and finally coming back to the initial position.

1.6 Research Outlines

- Chapter one is an introduction including the objective and the general idea of the project.
- Chapter two show the literature review of the robotics arm.
- Chapter three is the methodology which used to solve the problem of this project was built.
- Chapter four include the simulation and the hardware of the project.
- Chapter five include the conclusion and recommendations.