RWANDA POLYTECHNIC

KARONGI COLLEGE

PROJECT PROPOSAL

DESIGN AND IMPLEMENTATION OF AUTOMATIC CAR WASHING SYSTEM

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Final year project proposal submitted in partial fulfillment of the requirement for an award of the Advanced Diploma degree in department of electrical and Electronics engineering in electrical technology.

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DECLARATION

We are NTIRENGANYA jean D Amour and NSABIMANA innocent, Registration number 22RP11857,21RP02809, we declare, to the best of our knowledge that no part of this report has been submitted elsewhere, either in whole or in part, for any academic qualification. The work will be present in this report titled "**design and implementation of automatic car washing system"** is submitted for the fulfillment of an advanced degree in Electrical and Electronic engineering at the RP KARONGI collage.

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APPROVAL/CERTIFICATE

BYIRINGIRO Romeo and NDACYAYISABA Daniel we approve that this research project proposal has been submitted under our guidance, support, and approval.

Supervisors name: **Signature:** **Date:**

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LIST OF ABBREVIATIONS

RP: Rwanda Polytechnic

IR: Infrared

USB: Universal Serial Bus

IDE: Integrated Development Environment

EEE: Electrical and Electronic Engineering

AC: Alternating Current

DC: Direct Current

PWM: Pulse Width Modulation

ICSP: In Circuit Serial Programmer

MHZ: Mega hertz

RWF: Rwandan Franc

ABSTRACT

In the modern world, technology has linked each town, city and country with the other through means of transportation. This has ultimately leads to a massive increase in the number of vehicles. To clean this vehicle there is a need of a proper washing system. the most common problem often encountered while cleaning these vehicles is time consumption.

So this project will be developed to reduce the time to clean vehicles. The exterior of the car will be washed by detecting the car on conveyor belt and the processes are controlled by Arduino. The sensors are placed on conveyor belt at different places for car detection, washing, cleaning and drying. This system can be applied in car manufacturing companies after final assembly of car, service station, car replacing and maintenance station and car body building industry.

In this project we will use a conveyor belt for moving car from different place. IR sensor plays essential role on conveyor belt for car detection. When the car presence on conveyor the IR sensor1 will detect the car and then send the data to the Arduino and then the conveyor belt start moving the car on washing stage, as car reached to next IR sensor then soap pump start to open for same duration and spray the soap water on the car. After seted time pump will be stopped and again conveyor start moving until it reach to the next IR sensor3(brushing section). As the conveyor stops vertical brushes starts brushing the car for seted time(10s), after that time dc motor stop working, again conveyor starts moving until it will reach to the next IR sensor4(clean wash section). For this stage pump start to spray fresh water to clean the car, after 10 second the pump stop working. again conveyor start moving until it reach to the next IR sensor5(drying section) for this stage the dryer start and after 20 second dryer stop automatically and car get cleaned up. The main aims of our project is use less time, less water for more efficient washing.

Chapter 1: GENERAL INTRODUCTION OF PROJECT

1.INTRODUCTION

As the technology is upgrading day by day and everyday it creating our life easier, so we have to take advantage of these advancements. The world is trending towards fastest technology, by looking at all these aspect, the idea came to our mind to make automatic car washing system. The car washing system is usually associated with fuel filling stations. It will be consisted of many components with automated process.

Automatic car washing system will be fully automated with different stages like detection, washing, cleaning and drying. Mostly it is done manually in automobile garage or service centers of automobile companies.

This manual way of cleaning car results in more consumption of water, large number of manpower and more time required. The automatic car washing system reduces the use of water and also manpower requirement.

In this project, a prototype in which a car enters a washing station and automatically gets cleaned up as we will present. The various components such as conveyor belt, IR sensors, dc motor, dc pump motor, brushes and drying fan will be used. All these components are controlled using Arduino. Cycles of washing includes washing with water, and then with detergent. By using this automatic car washing system many cars will be washed and it will save time, energy and reduce manpower required. [1]

1.1: Background of the study

The idea of an automatic car washing system emerges as potential solution to the challenges posed by manual washing. Traditionally, car washing has been a manual process that is labor-intensive, time-consuming, and often results in excessive water usage and inconsistent cleaning quality. As the number of vehicles on the road increases and urbanization accelerates, there is a greater need for automated systems that can deliver reliable and high-quality cleaning with minimal human intervention. Automation in car washing not only reduces manpower and operational costs but also helps conserve water and energy, addressing both economic and environmental concerns. With advancements in microcontroller technology, such as Arduino, it is now feasible to design affordable and programmable systems that integrate sensors and actuators to automate the entire car washing process, from vehicle detection to washing and drying.

By integrating these technologies, this project aims to optimize water and energy usage, improve cleaning consistency, enhance safety through sensor integration, and reduce human intervention. [2]

1.2: Problem statement

The traditional manual car washing process is often inefficient, time-consuming, and labor-intensive, leading to high water and energy consumption as well as inconsistent cleaning quality. Manual washing requires significant human effort, which increases operational costs and limits the number of vehicles that can be serviced in a given time.

To correct this issues, we develop the Automatic car washing system that can optimize water and energy usage, improve cleaning consistency, enhance safety through sensor integration, and reduce human intervention.

1.3: Objectives of the study

1.3.1: General objective

The main objective will be to design and implement an Automatic car washing system using Arduino that reduces water consumption, manpower requirements, and operational time while ensuring consistent cleaning quality.

1.3.2: Specific objectives

i. To develop a system capable of detecting vehicles Automatically using sensors.

ii. To Automate sequential operations including washing with soap water, cleaning and drying.

iii. To minimize water usage through controlled spraying mechanisms.

1.4 Research questions

The following are question to be solved.

1. How can we make Automatic car washing system?

2. how does the system detect the presence of a car?
3. what are the key hardware components used in automatic car washing system?

1.5 hypothesis of study

1. To create an automatic car washing system, we made combination of mechanical components, sensors, and micro controller systems.

2. Vehicle detection systems work by using IR sensors devices placed on roads to spot cars. These sensors collect data such as the presence, speed of vehicles and it is sent to micro processer in order to analyzing it.

3. an automatic car washing system integrates mechanical elements (conveyor, brushes, pumps), electrical components (dc motors, IR sensors, relays), and a control system (microcontroller) to automate the washing, soaping and drying processes efficiently and reliably.

1.6 Significance of Project

1.6.1. Personal interest

This research project was a great opportunity for final-year students in electrical and electronic engineering to increase our knowledge and understanding of the use of components used in this project.

1.6.2. Social Interest

society will benefit from this project this system aims to enhance, improve energy efficiency, boost security, and integrated user experience.

1.6.3 Academic Interest

This project will help academics to improve their level of education and help us the students to gain more skills, and experience to do more research related to it.

1.7. Scope of the project

The scope of this project is to develop a fully automated car washing technology for cleaning vehicles efficiently and effectively by integrating sensors, controllers and mechanical component. This automation ensures consistent cleaning quality while reducing human effort and operational errors. The system designed to detect the presence of a vehicles and manage the sequences of washing automatically that making it user friendly and reliable.

1.8. Organization of the Study

This study is structured into five distinct chapters to comprehensively cover all aspects of the Automatic car washing system project.

Chapter One: General Introduction

This chapter provides an overview of the project, including the introduction, background of the study, problem statement, research objectives, research questions or hypotheses, scope and limitations, and the significance of the study.

Chapter Two: Literature Review

this chapter offers theoretical concepts, fundamentals tools and languages that support this project during development process.

Chapter Three: Research Methodology

this chapter focus on software development methodology used on this project and the data gathering techniques.

Chapter Four: System Design, Analysis, and Implementation

this chapter focus and describe the design and Implementation of project.

Chapter Five: Conclusion and Recommendations

The final chapter summarizes the conclusions drawn from the study, provides recommendations based on the findings, and suggests areas for further research. This systematic organization ensures a clear structure for the research and presents information in a coherent and logical manner, facilitating understanding and evaluation by the reader.

CHAPTER 2: LITERATURE REVIEW AND THEORETHICAL FRAMEWORK

2.1 Introduction

This chapter examines the available relevant literature on the topic under study carefully. Weaknesses, gaps, immediate relevance, and contributions are highlighted in this review, this chapter will include the evaluation of prior project by other scholars, as well as the primary concept of the project, the explanation of numerous units, and general principles. This chapter relates on discussion about some components which will be used in implementation of Automatic car washing system and expands on techniques to be used with a view of providing an overview of your project. A literature review is a survey of scholarly sources such as books, internet and on a particular topic. it gives an overview of key findings, concepts and developments in relation to a research problem or question, relevant materials written by other researchers providing information supporting the topic of the study. In this chapter, a review of past work and research papers related to the project is examined. The project looks at many areas, at first the needs is to increase the automated technologies for car users and to reduce time required, after that a technical section that is important for the scope of the project is reviewed.

2.1.1Available relevant literature

Several studies emphasize the use of Arduino microcontrollers as the core controller for automatic car washing systems. Arduino manages various components such as conveyor belts, sensors (infrared, obstacle sensors), dc motors, pumps, brushes, and dryers to automate the entire washing cycle. Sensors detect the car's position and trigger sequential washing stages including water spraying, brushing and drying. This automation reduces manpower needs, water consumption and ensures consistent cleaning quality. They also minimize the risk of car body scratches by avoiding direct manual contact. The automation ensures faster washing cycles, saving time and increasing through output. [3]

2.1.2 Gaps and contribution

In those above relevant of car washing system it has gaps of cleaning car by manual and effect of require more time and less cleaning quality.

Our contribution is to connecting devices which will help to cleaning that car by automatically and drying after cleaned.

2.2 key terms

2.2.1 car washing system

A car washing system is a specialized setup designed to clean vehicles efficiency and effectively. These systems can be applied for car body building and car station where customers need to washing their cars using automated system. Therefore, to clean these vehicles we need high pressure water jets with minimal human intervention. Modern Car washing systems also incorporate water recycling and filtration technologies to minimize water usage and environmental impact. Overall, car washing systems offer a convenient and consistent way to maintain the cleanliness and appearance of vehicles while saving time and effort for car owners.

2.3 main components of the system

2.3.1 Arduino Uno

A microcontroller board based on the AT mega 328 is called the Uno with cable. It contains 6 analogue inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button.

It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or battery.

Its act as the central control unit that managing the sensors, dc motors and pumps.

Figure 1: Arduino Uno

2.3.2 IR sensor

It is used to detect the presence and position of the car at various stages of the washing process. Multiple IR sensors are placed along the conveyor to trigger different actions.

Figure 2: IR sensor

2.3.3 Dc motors

It is an electric machine used to convert direct current energy into mechanical energy. This motors are controlled by the Arduino to start or stop conveyor based on sensor inputs.

Figure 3: servo motor

2.3.4 Submersible water pump 3v-5v Dc

A submersible pump is a pump that can be fully submerged in water. The motor is hermetically sealed and close coupled to the body of the pump. A submersible pump pushes water to the surface by converting rotary energy into kinetic energy or pressure energy. this is done by the water being pulled into the pump.

A water pump's is a small electric pump powered by direct current (DC) electricity, typically supplied by batteries, or other Dc power sources such as 3V, 5V systems. it is designed to move pressurized water by converting electrical energy into mechanical energy through a DC motor.

Figure 4:submersible water pump DC 3V-5V

2.3.5 relay

Relays are electromagnetic switches that are used when multiple circuits need to be controlled by signal or when a low power signal is needed to turn on and off a circuit.

Figure 5: relay

2.3.6 brush motors

This motors are used to drive brushes that scrub the car surfaces during the cleaning stage.

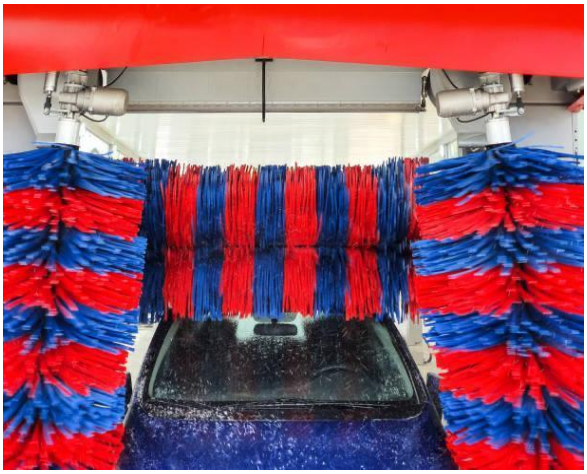

Figure 6:: brush motor

2.3.6 drying fans

This fans are activated at the drying stage to blow air and dry the vehicles.

Figure 7:drying fan

2.3.7 conveyor belt

A conveyor belt is a continuous loop of material that moves over two or more pulleys to transport goods, materials, or products from one point to another. It is the carrying medium of a belt conveyor system, which typically includes pulleys (drive), rollers to support the belt, and a motor to power the movement.

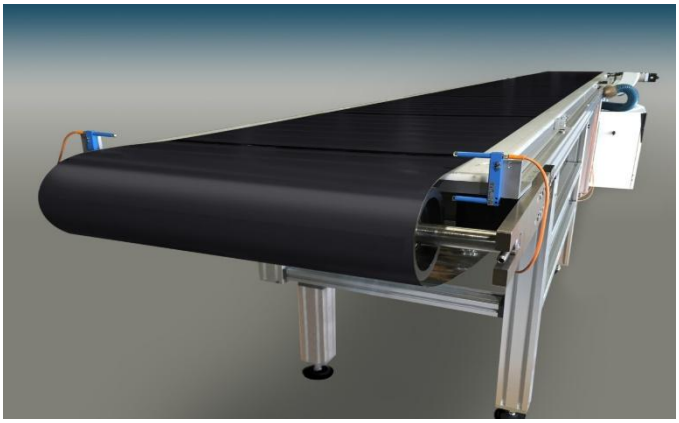

Figure 8: conveyor belt

CHAPTER 3: METHODOLOGY

3.1 introduction

This chapter describes the system flow chart and algorithm with the explained working principle of the designed circuit diagram and block diagram of our project. Algorithm clarifies the step in which the system operates and guiding in time of developing Arduino programming that control the embedded system. Here's how you might structure such an introduction: the material will be used are following Arduino Uno, IR sensor, Dc motors, Submersible water pump Dc 3v-5v, relay, brush motors, drying fans, conveyor belt. The method will be used to construct all system that helps to wash vehicles.

3.2 methods

3.2.1 data collection

- ✓ **Sensor Readings:** infrared(IR) sensors are placed at different points along the conveyor belt. These sensors detect the presence of car at each stage (washing, brushing, rinsing, drying) and send signals to the Arduino. The Arduino records these signals to monitor the car's position and control the cleaning process.

- ✓ **Timing data:** The Arduino uses timers in its code to control how long each cleaning stage runs. For example, 10 seconds for washing or drying. These time intervals are recorded and can be adjusted based on observations during testing.

- ✓ **System performance:** Observations are made about how smoothly the system runs, how accurately the sensors detect the car, and whether each stage operates for the correct amount of time. Any problems or errors are noted for improvement.

3.2.1.1 Hardware device of our project

1. Arduino Uno
2. IR sensor
3. Servo motor
4. Submersible water pump Dc 3v-5v
5. relay
6. brush motors
7. drying fan
8. conveyor belt

3.2.1.2 Software system

1. Arduino IDE (Integrated Development Environment): is a software which used to programming Arduino.

2. Proteus: will be used to simulate, design, and drawing of electronic circuits.

3.2.2 system construction and flow chart

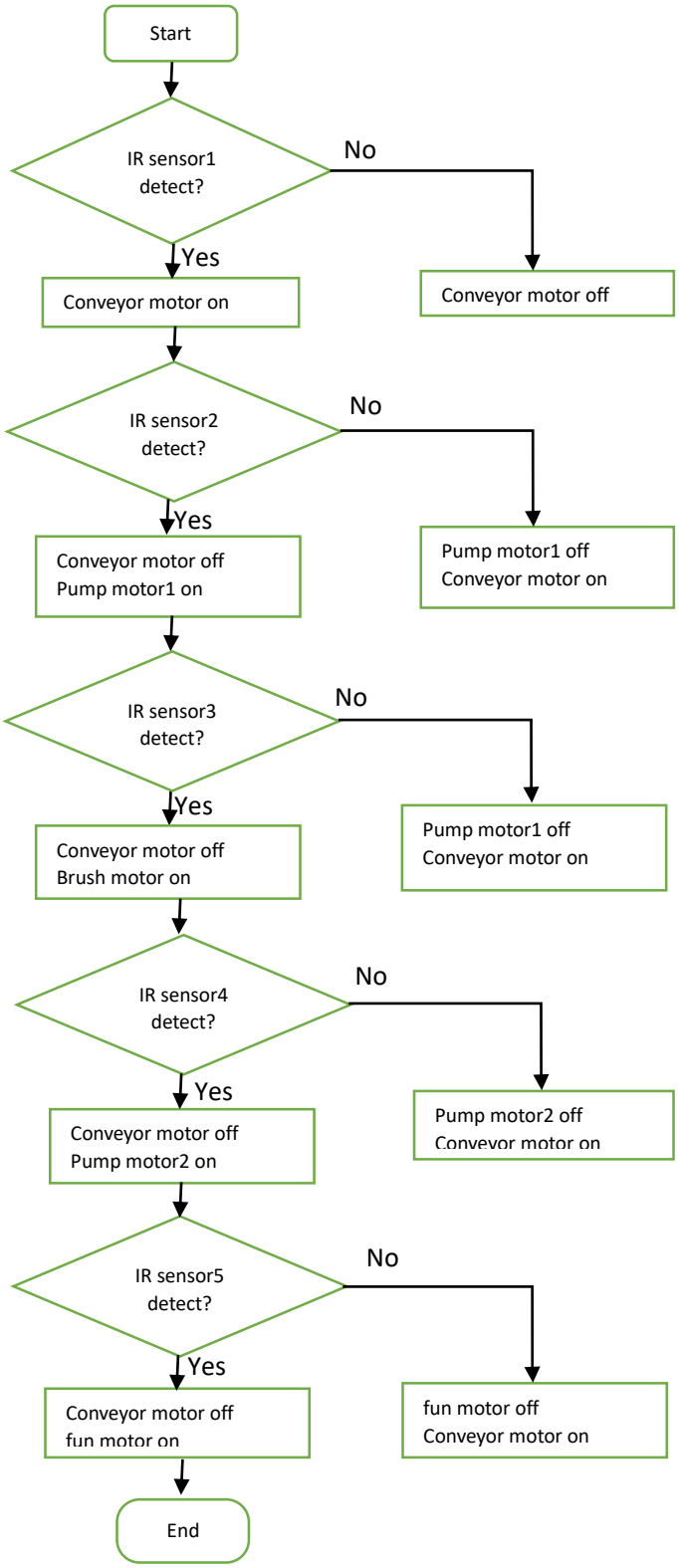

Figure 9: flow chart

A block diagram is a graphical representation of a system, project. It provides a functional view of a system and illustrates how the different elements of that system interlink. Engineers in particular use block diagrams to model the elements of a systems and understand how they are all connected.

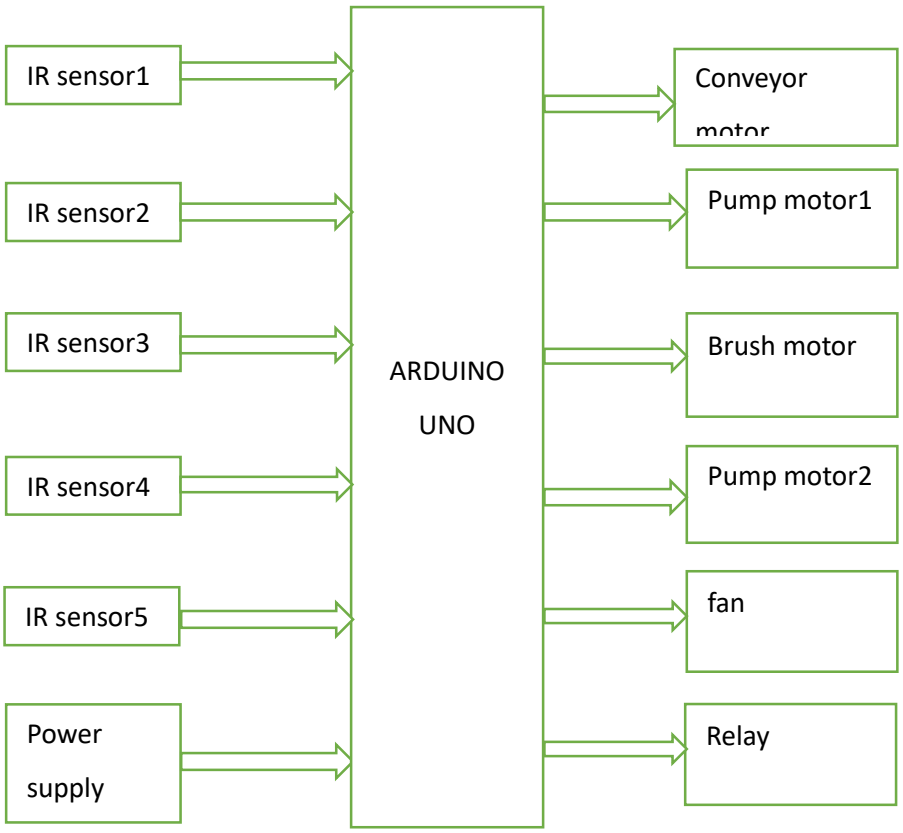

Figure 10:block diagram

CHAPTER 4: EXPECTED RESULTS

At the end of our research expected results are the following

- System capable for car detection will be developed
- Conveyor belt will be constructed
- Sprayed water will be controlled

In automatic car washing system we will perform all sequences operation needed to clean car like detection, washing, brushing and drying that are controlled by Arduino.
The result of the research is the realization of an automatic system, namely an automatic car washing system that uses mechanical and electrical systems. The system functions as a car wash system that works automatically. Consists of several components such as motors, pumps, control systems and sensors. The design is in the form of prototype on a small scale. The system will work when a car enters the starting position.

5.ESTIMATED COST OF OUR PROJECT

S/N	Materials	Quantity	Price	Total price
1	Arduino Uno	1	15,000RWF	15,000RWF
2	IR sensor	5	3,000RWF	15,000RWF
3	Servo motor	2	9,500RWF	19,000RWF
4	Submersible water pump Dc 3v-5v	2	2,500RWF	5,000RWF
5	relay	1	5000RWF	5000RWF
6	brush motors	3	6,000RWF	18,000RWF
7	drying fan	1	9000RWF	9000RWF
8	conveyor belt	will be designed	Will be designed	Will be designed
10	Jumper wire(male and female)	90	50RWF	4,500RWF
	TOTAL			**90,500RWF**

Table 1:cost estimation

5.1: TIME FRAME OF OUR PROJECT

ITEMS	June				July				August				September				October			
	W 1	**W 2**	**W 3**	**W 4**	**W 1**	**W 2**	**W 3**	**W 4**	**W 1**	**W 2**	**W 3**	**W 4**	**W 1**	**W 2**	**W 3**	**W 4**	**W 1**	**W 2**	**W 3**	**W 4**
Title Selection Project																				
Finding Related Information																				
Chapter 1																				
Chapter2																				
Chapter3																				
Chapter4																				
Chapter5																				
Submit Report																				
Presentation FYP																				

Table 2:time frame

Conclusion

This prototype will help to perform car washing automatically results in high quality end product. Thus it will be user friendly and capable to wash multiple cars in few minutes. Also require less man power, time and no pollution.

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