ARTIFICIAL INTELLIGENCE-BASED MECHANICAL WAXING APPARATUS

A Research Paper

Submitted to

The Faculty of Francisco Ramos National High School

Concepcion, Kabasalan, Zamboanga Sibugay

In Partial Fulfillment

of the Requirements in Inquiries, Investigations, and Immersions

Science, Technology, Engineering, and Mathematics

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June 2023

RESEARCH ABSTRACT

Cleaning houses manually with the utilization of floor wax has been a hassle for every people with smooth cemented floors for decades. In this study, we developed an artificial intelligence-based machine that automatically waxes the floor effectively and efficiently, and with the usage of artificial intelligence (A.I.), it has the potential to revolutionize many aspects of our daily lives, including the way we clean and maintain our floors. In particular, A.I.-powered floor waxing machines can offer significant benefits over traditional cleaning methods. By using machine learning algorithms to analyze the surface of the floor and adjust the waxing process accordingly, the machine can achieve a more precise and efficient way of cleaning. Additionally, A.I.-powered machines can adapt to changing conditions and learn from their experiences, leading to even better performance over time. As such, AI-powered floor waxing machines offer a glimpse into the exciting possibilities of integrating artificial intelligence into everyday tasks. Hence, the researchers created an A.I.-based product to lessen the hassle of cleaning cemented floors manually. There are previous studies that created artificial intelligence-based machines as cleaning apparatus by merely brushing or polishing cemented floors automatically. But different from previous studies, our product will clean floors by not only brushing but also by waxing. Our product will utilize an Arduino Board as the A.I. that will simultaneously enable the dispenser and brusher to effectively clean smooth cemented floors automatically. The effectivity of this particular product will be tested by utilizing a descriptive research design in order to describe systematically and accurately the facts and characteristics of the mechanical wax dispenser by the given population, and the sample size of the population will be systematically chosen by utilizing Slovin's formula and the use a simple random sampling technique to randomly acquire the calculated sample size out of the population.

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Chapter 1

Background of the Study

Floor wax is one of the most important inventions ever, if only for the fact that it gives people a quick and easy way to maintain the pristine appearance of any school's flooring no matter the weather. As you may already know, floor wax works to keep the shine on any floor surface whenever it is applied. In addition, for most people, how shiny and clean their floor looks plays a huge role in making the interior of the school appear a whole lot better.

School administrators must maintain the cleanliness and usability of their educational establishments. However, there are often significant barriers to doing so, including Special Events and Increased Use of Facilities After a special event, many school administrators are barely able to finish cleaning up before beginning preparations for another event in the same space. This often results in surface-level cleaning taking precedence over sanitation and deep-cleaning, which are necessary for the health of all students and staff Inadequate Staffing Many schools operate on small numbers of janitorial and cleaning staff often leaning on teachers to chip in.

Other schools have the opportunity to hire staff members who could play a role in keeping schools clean and tidy but are unable to find qualified, experienced individuals to fill open roles. Limited Funds Schools at every educational level struggle to stay afloat using their allotted funding. This can make it difficult to hire and provide regular pay for the cleaning staff who are making more than the current starting wages. We need to address these gaps to create an environment that is

conducive to teaching means ensuring lecture halls, classrooms, study, and living areas are all kept clean and tidy. Since messy and dirty classes not only present a poor image but can also be distracting and negatively impact the pride students have in your school

Statement of the Problem

This study determines the feasibility of Mechanical Waxing apparatuses that can wax the floor effectively. The findings will then serve as the basis for a proposed action plan. It focuses on Francisco Ramos National High School utilizing some Senior High School Students as research participants. The study will be conducted during the school year 2022-2023.

Specifically, this study sought to address the following:

1. Can a mechanical floor waxing machine avoid obstacles as it waxes the floor?
2. How much wax will be utilized in a specific area allocated in square meters?
3. Is there any significant relationship between the number of minutes it takes to wax the floor and the specific area allocated in square meters?

Hypotheses

The following hypotheses shall be tested using the 0.05 level of significance:

Null Hypothesis: There is no significant relationship between the number of minutes it takes to wax the floor and the specific area allocated in square meters.

Alternative Hypothesis: There is a significant relationship between the number of minutes it takes to wax the floor and the specific area allocated in square meters.

Scope and Delimitations of the Study

The focus of this study is to maintain cleanliness and provide a healthy and sanitary environment for students, by way of manufacturing an artificial intelligence-based floor wax dispensing apparatus. To effectively wax floors in educational environments automatically. The researchers conducted this study from June 2022 to July of 2023 at Francisco Ramos National High School, Concepcion, Kabasalan, Zamboanga Sibugay. The range of this study is limited to only waxing in plane cement surfaces. It does not include rough cement surfaces, tiles, and ground floors. This product also does not polish floors, but merely waxes them.

Significance of the Study

This study aimed to make a wax dispenser that is useful in waxing the floor quickly and easily to maintain the pristine appearance of the floor using Artificial Intelligence. This research shall benefit the following:

School. This study can be very useful to improve the cleaning style of teachers and students in their respective rooms quickly and easily. It helps them

to save their time and effort to wax the floor by hand. Instead of taking time in waxing the floor, they can use it for something more important like studying or doing school work. It also keeps them looking good and pleasantly throughout the day because of the machine that takes place the role

Researchers. This study shall enrich the knowledge of the researchers regarding computer programming and technological devices. It allows them to expand their research capabilities and it will give them an in-depth explanation of the current explored research topic. As future engineers, the researchers can also utilize this study to better comprehend the vital aspects of inventing machines or devices that they can apply in their field of future roles.

Community. This study can help people in the community, especially in houses and buildings that are made from cement and wooden materials and whose ground surfaces are not built with tiles and floor mats. It will help them save money to hire someone to do the job and save effort to wax the floor by hand. Keeping their floors clean in an easy way makes their environment looks more pleasant and appealing that eventually helps them maintain a safe floor.

Future Researchers. This study is also beneficial to the upcoming researchers. This will help them to broaden their prior knowledge in terms of artificial intelligence and computer programming. This will also give them advanced ideas on what to modify or what needs to be improved in the finished product.

Definition of Terms

The following terms will be used extensively in this study and shall be taken according to the definition given below:

Artificial Intelligence (A.I.). It is the soul of our mechanical apparatus. It is the one who controls the product and is the reason for the automation of the apparatus.

Computer Programming. It is the process of inputting or assigning codes in our product for automation.

Floor wax. It is a material that will be utilized in our product for polishing or cleaning cemented floors effectively.

Robotics. It is the process of designation and construction of our mechanical apparatus.

Chapter 2

Review of Related Literature

This chapter presents the related studies and literature on Mechanical apparatus such as wax dispensers. It shows the relevance of certain studies which provides information that will support and guide the researchers in creating this particular apparatus. Machines for scrubbing floors offer a deeper and more advanced feature that makes cleaning much easier which employs a highly developed tool for a particular task. These can help increase production and efficiency through the advancement of technology, and automated floor cleaning machines which are getting more attention from researchers to make the life of mankind much easier and more comfortable. This Mechanical waxing apparatus is designed by keeping the basic considerations for education in cost and effort while being environmentally friendly and easy to handle.

Sensors like soil sensors, moisture sensors, relay modules, and Arduino Uno development boards are used to create smart irrigation systems (Kaushik, M. 2022). The primary goal of this project is to create a working vacuum robot prototype using an Arduino Uno, sensors, a DC motor, and a motor driver L298N. To accomplish the project's goal, a vacuum suction unit and ultrasonic sensor were used (Meghana K, Harshitha, Mahima Padmanabha, Naresh N Dikshit, B R Santosh Kumar, May 2019).

A floor-cleaning machine was modeled and analyzed in this work using commercially available software. The components of a floor cleaning machine were designed using conventional materials (Ranjit Kumar 2016). In this paper, an

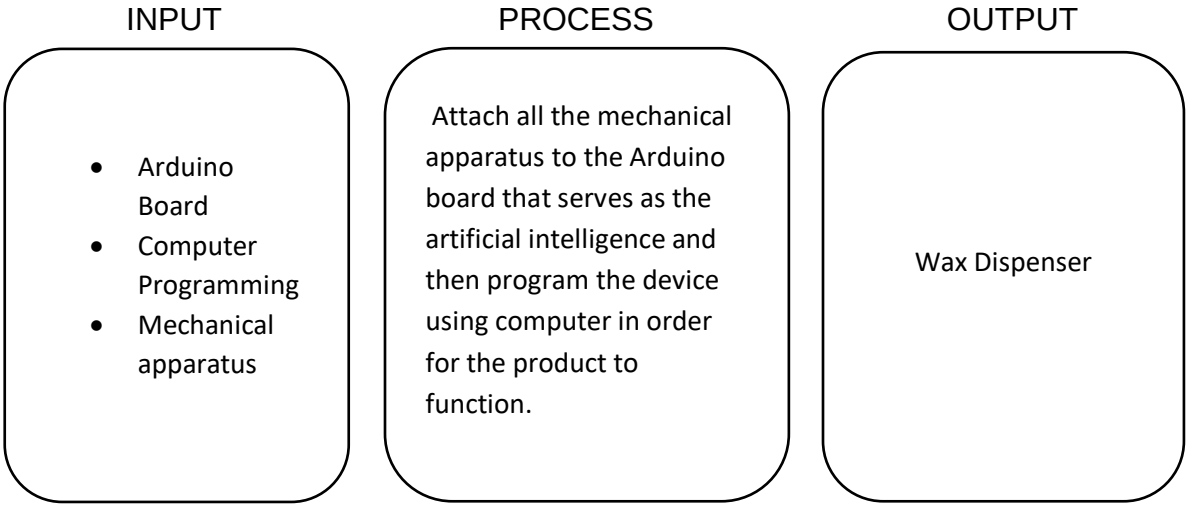
automatic mode robot controls all operations and changes lanes when a hurdle is detected and moves back. The keypad is used in manual mode to perform the expected task and to operate the robot. In manual mode, an RF module was used to transmit and receive information between the remote and the robot, as well as to display information about hurdle detection on the LCD. The entire circuitry is powered by a 12V battery (Kaur, M. and Abrol, P. 2014). The design and development of a Smart Home Cleaning device is illustrated in this paper. The goal of this paper is to design and develop a multitasking device to clean surfaces by performing various floor cleaning operations that is simple to use, portable, and cost-effective by utilizing an Arduino board (Mahajan, et at 2021). This project is a collaboration between the streams of mechanical, electrical, and electronic and makes use of these fields' equipment and infrastructure. It is an assembly of various rigid parts, such as chassis, some various electromechanical devices, including motors (Das, N. R., Daga, R., Avte, S., & Mhatre, K. 2019). An air-sucking, self-contained, autonomous, water-free robot was designed and developed. By incorporating the photovoltaic panel path into the robot, the developed robot can be tailored to each power plant. (Ölmez, et al 2021). This book discusses the manufacturing and applications of industrial robots. First providing an overview of robots, including historical background and technical developments, the test moves on to control problems and interfacing, robot software and programming, and the important new field of robot vision (Critchlow, A. J. 1985).

The task of cleaning the floor is significant and time-consuming; occasionally, we assign people to the task and pay them. However, as technology develops, households are becoming more automated and intelligent, which is convenient for the populace. This robot was made to make the task of cleaning easier. It is designed to clean homes, schools, and offices (Vijayalaxmi S Kumbhar, Dnyaneshwari Jagtap, Mansi Kulkarni, and Salim Lakade (2021). It aims to design and manufacture an ergonomic extended broom. It will assist housewives or even humans in doing house chores more effectively due to the product's ergonomic design and multi-function (Tuan Asmadi, T. M. A. I. 2022).

Based on the review of related literature, it has been found that there is a dearth of materials related to the relationships of the three variables. Hence, this study is proposed to focus on the relationships of variables 1 and 2 to variable 3 in the District of Kumalarang, Zamboanga del Sur.

Conceptual Framework

The conceptual framework of the study in shown in Figure 1.



An IPO type, this conceptual framework contains input, process, and output. Independent variables are those that are included in the input. Artificial intelligence serves as the primary system, followed by computer programming, mechanical devices, and robotic design. The process is then put into place to create or complete the output—the product. The floor polishing machine is the dependent variable and the output.

Chapter 3

Research Methodology

This chapter presents the research methods of the study. It includes a discussion on the research design and research methods covering the research environment, research subjects, sampling techniques, instrumentation, data gathering techniques, and statistical treatment.

Research Design

This study utilizes a quantitative descriptive research design to determine the effectiveness of Mechanical Waxing Apparatus as a Wax Dispenser. A descriptive research design is known as exploratory in nature with which to observe and report a certain phenomenon as it is happening. Descriptive research can provide an in-depth view of any topic we might want to study but cannot determine a cause-and-effect relationship (Megan Sumeracki). The researchers used this design to describe systematically and accurately the facts and characteristics of a wax dispenser by the given population. The information collected in this study underwent data processing in which the results observed will be the researchers' basis for its affectivity.

Research Locale

This study was conducted at Francisco Ramos National High School which is located in Conception, Kabasalan, Zamboanga Sibugay. The researchers select this area for the study be conducted since FRNHS contains approximately 30 or

more classrooms that provide a better place to test the Mechanical Waxing Apparatus as Wax Dispenser.

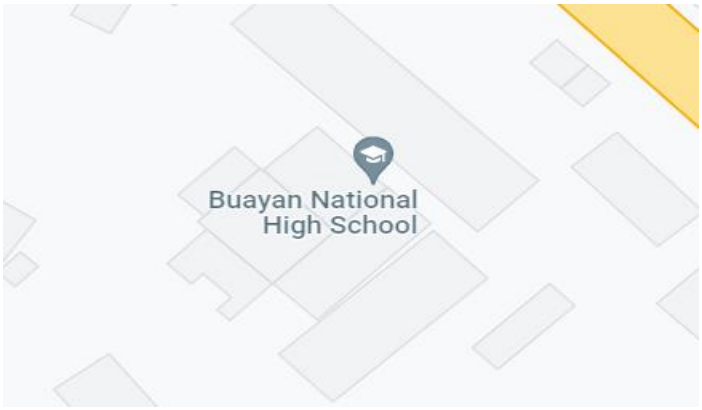


Fig. 1 Location of Francisco Ramos National High School

Research Respondents

The researchers selected the high school students of Francisco Ramos National High School to be the respondents of this study, preferably the Senior High School students. The researchers had come up with students from the grade 12 HUMMS track as their respondents because they are among those students who can criticize and evaluate someone's work and seem to have an interest when it comes to machine operation in Science Technology Engineering, and Mathematics (STEM).

Materials

- Arduino board
- Dynamos (4)
- Circuit board
- Sensor
- Wires
- Batteries
- Plastic/Metallic base
- Wheels
- Gears
- Button/Lever
- Screws

- Dispenser
- Storage
- Valve
- Heating wires/Cables

Sampling Techniques

The researchers will utilize Slovin's Formula in choosing the respondents in this study. Slovin's Formula is used to calculate the sample size (n) given the population size (N) and a margin of error (e). (Slovin's 1960) the researchers will determine the sample size by manipulating the population size and margin of error and then use a simple random sampling technique to randomly acquire the calculated sample size out of the population.

Research Instruments

This study utilized an observation checklist which is a form that is used for quickly and easily recording data or identifying actions or requirements. It is usually easy to extract data in a useful manner from a checklist. It is particularly effective at registering the occurrence of incidents, events, tasks, or problems (Digital Healthcare Research).

Data Gathering Procedure

During data gathering, the researchers will be using an observation checklist as their research instrument. The researchers will set up the Mechanical apparatus as a wax dispenser in a specific location and prepare the observation checklist with specific items to be observed such as the amount of wax dispensed and the time it takes to dispense. A reliable observer will record the data on the

checklist and note the time, date, and location of the observation. We will repeat the observation process several times to ensure data accuracy and consistency. After compiling the data from the checklist, we will analyze the data to conclude the product's effectiveness. Permission to conduct the study was asked from the school principal Ms. Rosalie Milla and Ms. Cassandhra Pearl Emperado, our research adviser. Once approved, the consent to participate in the study and the observation checklist were sent to them personally by the researchers. The data will then be collected and tabulated.

Statistical Treatment

The data that will be gathered is the amount of wax consumed by the mechanical waxing apparatus, the duration (in minutes) it takes to wax a specific area that will be manipulated during three treatments, and the indication if the mechanical waxing apparatus will avoid obstacles as it waxes. Which will all be acquired from the randomly selected respondents. The first set of gathered data (which is related to the amount of wax the machine will consume) will be treated statistically by getting the weighted mean of the data that will indicate such data, and the second set of data that will be gathered (that is related to the indication if the mechanical waxing machine will avoid obstacles successfully) will be treated by also utilizing the weighted mean based from the respondents' response which will consequently give an accurate indication if the product performed successfully in relevance to its related research question. Lastly, the third set of data that will be gathered (which is related to the duration it takes to wax a specific area, specific

areas that will be manipulated in three treatments) will be statistically treated by utilizing ANOVA or Analysis of variance, which is an analysis tool used in statistics that splits an observed aggregate variability found inside a data set into two parts: systematic factors and random factors. The systematic factors have a statistical influence on the given data set, while the random factors do not. Analysts use the ANOVA test to determine the influence that independent variables have on the dependent variable in a regression study (Kenton, 2022).

References