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Smart Automated Table Cleaning Device

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***Abstract*— This paper presents an innovative design for a smart and automated table-cleaning device, aiming to enhance efficiency and hygiene in busy environments. The proposed solution utilizes advanced technologies, including Arduino Mega, ultrasonic sensors, L293D motor driver, pump motor and dc motors, to autonomously clean tables based on predefined commands. The device caters to the demands of modern urban lifestyles, addressing the challenges of managing household chores in dual-income households with erratic schedules. With features such as obstacle detection, prevention of accidental falls, and wiper-based wheels for effective dust removal, the device is particularly suitable for restaurant settings with a constant influx of patrons. In the context of the ongoing automation trend in the hotel management industry, this device offers a cost-efficient solution to streamline table maintenance and uphold cleanliness standards. At present where the whole hotel management industry is trying to automate everything, this can be the potential device for tables at restaurants where there is always rush and the wants to cost efficient work**

I. INTRODUCTION

In today's fast-paced world, the demand for convenience and cleanliness has led to innovative solutions. One such advancement is the smart automated table self-cleaning device, a fusion of cutting-edge technology with practicality and hygiene. As our lives get busier and expectations for cleanliness rise, this device emerges as a beacon of technological progress. This presentation explores its design, technology, impact, components, working principles, market potential, and the challenges overcome, offering insights into a transformative invention shaping the future of dining and smart, automated solutions in our daily. This paper focuses on the evolution from labor-intensive cleaning methods to the implementation of an automatic floor cleaner, driven by automation and user commands via mobile devices. The project's central goal is to design a robot utilizing Arduino Uno, Motor driver L293D, Ultrasonic Sensor, and LCD display The intelligence of the robot lies in its computer logic, enabling autonomous movement guided by a designed logic controller. In contemporary society, robots play a vital role across industries, households, and institutes, with an increasing level of intelligence comparable to humans. Sensors gather environmental information, transmitting signals to the microcontroller—the robot's brain, where programs are executed based on inputs from sensors and outputs to actuators. This introduction outlines the historical context, technological evolution, and the overarching objective of reducing cleaning burdens through intelligent automation.

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II. Literature Review

Irawan et.al. [1] This research paper includes the working and implementation of tools such as Ultrasonic Sensor, Motor Shield L298, Arduino Uno microcontroller, Servo, and DC Motor. These tools help detect objects on a floor then the device will clean them automatically. Rajan et.al. [2] This research paper illustrates the programming of microcontrollers to acquire a decision for any given input and output in order to drive motors in forward and backward direction or left and right direction. The working is on the call when the button is pressed and the DTMF (Dual Tone Multiple Frequency) tone will receive the signal. Vatsal Shah et.al. [3] To perform wet cleaning , it is attached with a simple attachment at the rear end of a robotic floor cleaner. It is a cotton cloth attached toa sheet made up of foam with the help of Velcro. It is washable as well as replaceable. Chuanmei, and Zongyi WEI et.al. [4] This research paper illustrates an automatic cleaning machine which is composed of a cleaning brush, detergent spraying mechanism and a crosswise horizontal retractable mechanism for the cleaning process. Ramesh, P. et.al. [5] This paper shows us how we can use arduino and ultrasonic sensors to measure the distance between sensor and object.

G Tuangzhi Dai and Tiequn Chen et.al. [6] This research paper illustrates an Automatic Cleaning and Mopping Robot. The robot starts by activating a simple switch. It simultaneously starts cleaning and Mopping the floor from one end to another. Robot changes the path if it encounters an obstacle. It can also be controlled by mobile phone using Bluetooth. Vinodkumar Jacob et.al. [7] Automatic home floor cleaner with the intention of improving their efficiency and mobility. Ultrasonic sensors to enable a cleaner robot system to avoid unexpected obstacles. It is a self-powered and self-directed robot cleaner system which is able to mop, dry floors and drain spilled water from floor surfaces. H. Asada and J.E.Slotin et.al. [8] In case of any head on obstacles it takes a clockwise or anti-clockwise turn, in case of absence of obstacles, it checks for any impact on bumpers. If any impact is detected, the robot moves away from the impacted object and in absence of impact it moves forward and checks for obstacles. .M.R.B. Bahara et.al. [9] When the robot will find the particular dust size on the floor on one side of it and there are less on the other 3 sides, it will head towards the dusty area if an obstacle is not present. It is time redundancy and power saving with low cost. Mittal, G. et.al. [10] This research paper shows the effectiveness of deep learning techniques for the floor cleaning task which generates the cleaning path according to the detection of obstacle litter and then the cleaning action is carried out.

Iwan Ulrich et.al. [11] Its advanced navigation system seamlessly navigates working non-stop until your home is beautifully clean. A full suite of sensors and an optical mouse system helps the AFCR map your home. It is designed for real homes and large-scale industries inspired by various vacuum cleaners present in the market. Manya Jain et.al. [12] This research facilitates efficient floor cleaning with sweeping and mopping operations. This robot works in two modes automatic and manual for user convenience. This proposed work provides the hurdle detection in case of any obstacle that comes in its way.

III. Methodology

The proposed autonomous, self-cleaning robotic system represents a sophisticated solution aimed at addressing the increasing demand for efficiency in contemporary society. Employing a strategic integration of advanced technologies, the system is built upon the robust foundation of an Arduino Uno board, Ultrasonic sensors, Pump Motor, L298 Motor Driver Module, and 100RPM DC motors, augmented by the precision of infrared sensors. The meticulous engineering of this automation endeavors to optimize the table cleaning process, aligning with the imperative for swift and effective solutions in our dynamic world.

The utilization of the L298N Motor Driver Module facilitates precise control over the direction and rotation of the 100 RPM DC motors, ensuring synchronized movement. The incorporation of ultrasonic sensors enhances obstacle detection, while the dispensing of soap water by the motorized pump contributes to hygiene maintenance. Additionally, the inclusion of Infrared sensors safeguards against accidental falls. Through the seamless coordination of these components, the robotic system operates cohesively to deliver a streamlined and expedited table cleaning process.

IV. Components Of Project

In this project various components like Ultrasonic Sensor, Infrared Sensors, L298N Motor Driver Module, DC motor, Arduino Uno and DC motor pump is used. Figure 2 to figure 7 shows components used.

A. Ultrasonic Sensor

Ultrasonic sensors are connected to Arduino and helps to prevent any object in its way the calculation part is like

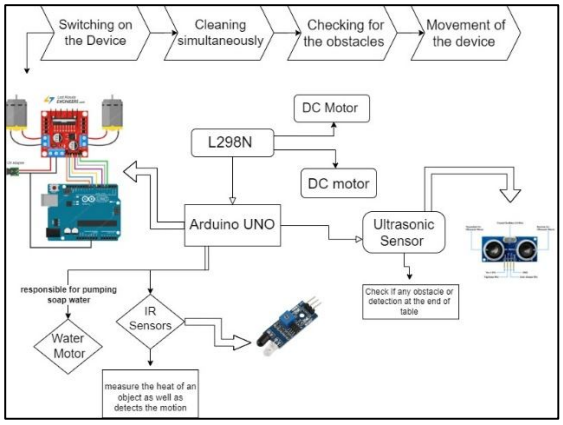

Fig. 1: Work Flow Diagram

Fig. 2: Ultrasonic sensors

Fig.3: Infrared Sensor

Fig.4:L298N Motor Driver Module

Fig.5:DC Motor 100 RPM

Fig.6:Arduino uno

Fig.7:DC motor pump

this.

Distance = Speed x Time.

It will measure the distance between bot and obstacles and when it is less than 3cm, bot will stop through communicating l298n motor driver module The sensor has 4 pins. *VCC* and *GND* go to *5V* and *GND* pins on the Arduino, and the *Trig* and *Echo* go to any digital Arduino pin. Using the *Trig* pin we send the ultrasound wave from the transmitter, and with the *Echo* pin we listen for the reflected signal.

This robotic system incorporates a sophisticated distance Measurement mechanism to enhance operational safety and efficiency. This functionality is achieved through the integration of Ultrasonic sensors featuring four connection pins. The VCC and GND pins are meticulously connected to the 5V and GND terminals of Arduino Platform, respectively. The Trig and Echo pins are strategically interfaced with designated digital pins on the Arduino. The Trig pin Facilitates the emission of ultrasonic waves from the transmitter, while the echo pin adeptly captures and processes the reflected signals. Specifically, this advanced configuration enables the system to halt its operation when the measured distance between the robotic entity and obstacles diminishes to the critical threshold, specifically, less than 3 centimetres. This communication is achieved.

B. Infrared Sensors

It consists of two main components: the first is the IR transmitter section and the second is the IR receiver section. In the transmitter section, IR led is used and in the receiver section, a photodiode is used to receive infrared signal and after some signal processing and conditioning, you will get the output.

C. L298N Motor Driver Module

L298n Motor Driver Module which is is a dual H-Bridge motor driver which allows you to control the Speed and

Direction of motors

D. DC Motors

DC motors are used for rotation of wheels.

F. Arduino Uno

The Arduino uno is a widely used microcontroller board featuring the ATmega328P processor, offering 14 digital I/O pins, six analog input pins ,PWN support, a USB interface for programming and power, and a 16MHz clock speed with an open source design. It is favoured for its simplicity making it an ideal choice for beginners.

G. DC motor pump

DC motor pump operates on 3v and it is widely used in small electronic projects

V. Results And Findings

The innovative smart and automated table-cleaning device described in the paper represents a significant advancement in addressing the challenges of maintaining cleanliness and efficiency in busy environments, particularly in restaurant settings.

As the hotel management industry continues to embrace automation, this device emerges as a practical and innovative solution that not only enhances efficiency but also contributes to a hygienic and welcoming environment for customers. The proposed table-cleaning device stands out as a promising contribution to the field, offering a valuable solution for the evolving needs of busy establishments seeking to optimize their operations and provide a seamless and clean experience for their patrons.

VI. Conclusions

The overall functioning of the device involves autonomously navigating through tables, detecting obstacles, avoiding accidental falls, dispensing cleaning solutions, and utilizing wiper-based wheels for effective dust removal. The use of advanced technologies and features makes it suitable for busy restaurant settings, aligning with the ongoing trend of automation in the hotel management industry. The device aims to provide a cost-efficient solution for streamlining table maintenance and upholding cleanliness standards in environments with high customer traffic.

References

[1] Irawan, Yuda, Muhardi Muhardi, Rian Ordila, and Roni Diandra. "Automatic floor cleaning robot using arduino and ultrasonic sensor." Journal of Robotics and Control (JRC) 2, no. 4 (2021): 240-243.

[2] Rajan, C., B. Megala, A. Nandhini, and C. Rasi Priya. "A Review: Comparative Analysis of Arduino Micro Controllers in Robotic Cars." International Journal of Mechanical and Materials Engineering 9, no. 2 (2015): 371-380.

[3] Vatsal Shah, “Floor Cleaning Robot with Mobile-App or Autonomous”, Dept of ECE IITE, Ahmadabad.

[4] HU, Chuanmei, and Zongyi WEI. "A Study on the Structural Design and Functional Simulation of an Automatic Cleaning Machine."

[5] G Tuangzhi Dai and Tiequn Chen “ Design on measurement and control system of cleaning ROBOT based on sensor array detection”

[6] Ramesh, P., Sai Sudheera, and D. Vinay Reddy. "Distance measurement using ultrasonic sensor and Arduino." Journal of Advanced Research in Technology and Management Sciences (JARTMS) 3, no. 2 (2021).

[7] Vinodkumar Jacob, M.Bhasi and R.Gopikakumari. Advance Instrument Engineering: Measurement, Calibration and Design.]

[8] H. Asada and J.E.Slotin, robot analysis and control a wiley-interscience publication.

[9] M.R.B. Bahara, A.R. Ghiasib, H.B. Bahara, "Gridroadmap based ANN corridor search for collision free, path planning ",Scientia Iranica.

[10] Mittal, G.; Yagnik, K.B.; Garg, M.; Krishnan, N.C. Spotgarbage: smartphone app to detect garbage usingdeep learning. In Proceedings of the 2016 ACM International Joint Conference on Pervasive and UbiquitousComputing, Heidelberg, Germany, 12–16 September 2016; pp. 940–945.

[11] Iwan Ulrich, Francesco Mondada, J.D Nidoud, Autonomous Vacuum Cleaner, Robotics and Autonomous Systems.

[12] Manya Jain , “Automatic Floor Cleaner” International Research Journal of Engineering and Technology.