



Smart Cleaning Bot

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Abstract: With advancing technology, mankind has begun to rely more on robots at every enhancing stage of technology and hence this arena of development has received great attention of the researchers. Along with the features of Smartphone controlled robot via Bluetooth which also senses the obstacle ahead with the help of sensors and tackles them accordingly while also sensing and tackling the depths in a similar fashion.

Arduino Nano is the development board used commands the overall action of the robot. An IR sensor is used as it transmits the infrared waves from IR emitter and receives the echoed waves of it through receives it through IR receiver and conveys the output to the Arduino Nano. The Arduino module will respond instantly as the data is received from the sensors and informs the user controlling through Smartphone via Bluetooth. The Servo motor is connected with the arduino module and operated by the user through the mobile phone, which acts as a drier mop in our model of cleaning bot. The drenched moping pads are actuated by the DC motor fixed thereupon. Signal to each & every motor is given by the central processing unit board i.e. Arduino Nano.

Index Terms- Arduino NANO, IR Sensors, Motor Driver, BO Motor, Servomotor, Bluetooth Module.

I. INTRODUCTION:

With the evolving era of mankind, humans are more reliant on the emerging technologies related to mental as well as physical exertions, to save time and efficiently process their regular chorus. Consequently reducing the human efforts and increasing the creativity of human mind in other domains.

That is the motive of existence of technology. During the initial stage of robotics, robots were only used for industrial automation purposes but now the table has turned and advanced, such that robots are utilized in every aspect of regular human life.

The robotics evolution is at the stage where robot completely resembles human. And the field of Humanoid came to existence. More importantly, such technologies have helped the elderly and handicapped work efficiently and conveniently while relying less on other individuals.

As humans are busy with their advancing hectic life, household work leading a minor & time consuming but essential for hygiene becomes a burden for this advanced human lifestyle. Cleaning floor is one of the major jobs among them. This problem can be tackled and resolved with the help of technologies with efficient and time convenience using robots. Our Robot solves this problem by reducing human efforts. Even minors can operate this robot using a Smartphone. The robot not only performs wet cleaning but also dries up the floor with help of a drying mop. As well as taking care of itself and other living or non-living existence, making a safe environment while performing its operation.

The robot can also keep the environment safe even when a child is operating it with a Smartphone due to its sensors and the way mop can be controlled by rising and lowering, can only be used when required. The water pump works in a similar manner by pumping the water when required. The water itself is contained in robot within a container which it carries all along its operation. The speed of the robot can also be controlled according to the desired output.

Resembling the structure of a panzer such cleaning bots can be further developed for defense proposes as well as public roads platforms with ease and efficiency.

This bot saves time and money for working in regular lifestyle of an individual.

II. LITERATURE SURVEY:

[I] Aishwarya Pardeshi and Group, this paper present the model of a cleaner bot. Vacuum cleaning machine installed with features like choosing and placing mechanism along with dirt container. Such a robot is in a way helping us to make our daily life more convenient.

[II] Ajith Thomas and Group, this paper presented an autonomous robot for floor cleaning using vacuum. It performs vacuum cleaning and detects obstacles and responds accordingly to avoid collision. It sprays water if necessary and has a manual method to operate. This project is developed using Raspberry Pi as its central processing unit board.

[III] Vaibhavi Rewatkar and Sachin Bagde, provided a thorough summary of the technical benefits that have benefitted the society as a whole and made life easier for the vast majority of extremely busy people. Thus, this led to the goal of building an automatic home appliance. This bot is designed for computerized cleaning with installation of wheels operated with DC motors, a dustbin for collecting the dust along with a cleaning brush as broom and a mop for cleansing. Powered by a 12V battery with obstacle detection and avoiding feature, it also has a UV germicidal cleaning feature. The whole project has been designed keeping in mind to keep the economical expense as low as possible.

[IV] Vinod J Thomas and Group, presented a cleaner robot for domestic home application. The basic feature of this robot is to clean every corner of the house. The robot is made to be able to reach almost any space and any corner of any room, it should be as compact as achievable. The robot is operated using a Smartphone over a Bluetooth Module. The robot was created with an Arduino microcontroller as its central processing unit board. The microcontroller is supplemented with communication modules such as a wireless Bluetooth motor and a dust collection system for proper operation.

[V] Manya Jain and Group, presented the project of Automatic Floor Cleaner. This project is designed for household as well as industrial purposes. It is installed with a brush to scrub the surface and a vacuum pump to clean the dust particles. While also has the feature to avoid obstacles if any with the help of sensors.

[VI] Abhishek Pandey and Group presented an Automatic Cleaning Robot which is essential for domestic purpose. The robot was constructed in a way that it would prevent wastage of time and money. No human involvement is required for controlling of the robot. The bot is controlled by Smartphone. Cleaner is designed for handicapped person as well. They had to cause this, so they needed a cleansing system that could add consistency to what we were saying and thereby physically endorse someone.

[VII] S Monica and Group, presented project based on floor cleaning with a neater way and efficiently by robot with wireless control. In the previous research papers, home appliance robots and automatic floor cleaning robots have some disadvantages such as colliding with objects first, this vacuum cleaner cannot reach small areas and leave behind This area is not clean. Therefore, the floor cleaning robot automatically vacuums dirt, but the disadvantage here is that it cannot clean wet floors. Some limitations in this project corroboration are fixed.

[VIII] Karthick.T and Group, to create an automated robot that can move without constant human guidance. Automatic cleaning robot deals with electrical components with low power consumption and it can operate at very low power. The electrical part is the Atmega 2560 control board, ultrasonic sensor, transformer IC and motor driver circuit. The motorized part is a motor unit with a reducer. The ultrasonic sensors will identify obstacles based on the running program. A 12V power supply is used in this project, 4.50Ah lead-acid battery for energizing the bot.

III. SUMMARY OF LITERATURE SURVEY:

An integrated analysis of the above literature surveys has helped design the "Smart cleaning bot", which is designed in such way that, the model will bare minimum weight as considering the components, along with automated functions. This will increase the efficiency and make the bot smart enough to take decision in harsh circumstances such as sudden depths and obstructions to stop and inform the user controlling it through Bluetooth.

Apart from these, an extra factor that makes the device unique is the use of servomotor, attached with a brush and a mop making it capable to clean every nook of the region.

IV. METHODOLOGY AND BLOCK DIAGRAM:

[I] METHODOLOGY:

The entire functions of the cleaning bot are operated through a Smartphone via Bluetooth by a user. At the front of the robot, two IR sensors are attached such that one detects depth and the other will detect the obstacles. As soon as any depth or obstacle is detected then this information is sent to the Arduino Nano i.e. the microcontroller of our project. This activity immediately stops the robot for further movement and information is sent to the user on his Smartphone regarding the depth or obstacle accordingly. Secondly, if the surface is dry, a pump is attached at the front, pumps water on the wet mop. Instructions of operation of this pump are given by the user operating through the Smartphone.

Two motors at the front of the robot are attached with a spongy cloth, altogether acting as the wet mop.

Thirdly, a drying mop is attached at the back of the robot, which is only used when required to increase the efficiency of the robot. This function is performed by a servomotor which either lifts or drops this mop as per the utilisation required by the user/operator. The servomotor is attached to the Arduino Nano and operated by user using a Smartphone via Bluetooth.

[II] BLOCK DIAGRAM

SMART CLEANING MACHINE BLOCK DIAGRAM

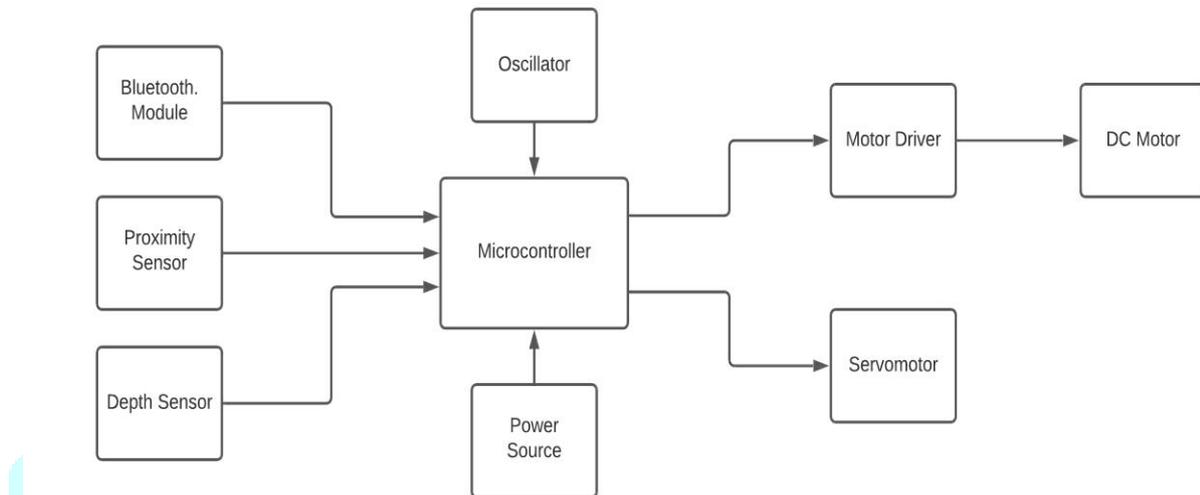


Fig. 1: Block Diagram

V. HARDWARE:

[I] MICRONTROLLER:

- The microcontroller used in this project is an 8-bit AVR family ATmega328P
- With a 5 volt operating voltage
- Vin pin input voltage should be between 7 and 12 volts
- Six analogue input pins (A0 – A5)
- 14 Digital I/O Pin (Out of which 6 provide PWM output)
- 32 KB Flash Memory (2 KB for Bootloader)
- 1 KB EEPROM
- Frequency (Clock Speed) 16 MHz
- Input/output Pins:-
Digital Pins D0 - D13
- Analog Pins A0 – A7:-
Used to measure analog voltage in the range of 0-5V
- PWM Pins 3, 5, 6, 9 and 11
Provide an 8-bit PWM
- LED13:-
To turn on the inbuilt LED

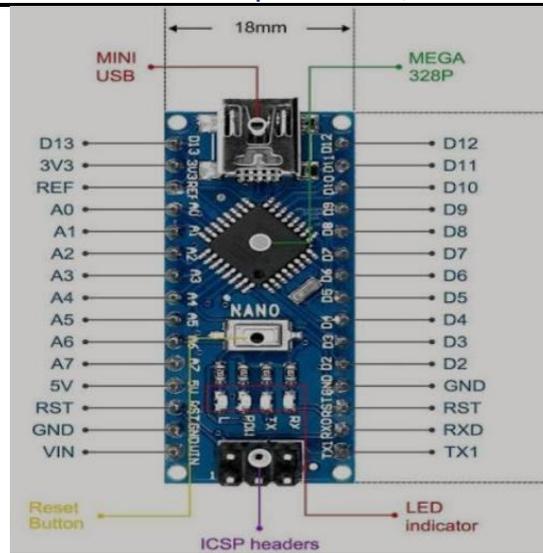


Fig. 2: Pin Diagram of Arduino NANO

[II] MOTOR DRIVER:

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current: 2A
- Logical Current: 0-36mA
- Maximum Power (W): 25W
- Heatsink for better performance
- Power-On LED indicator

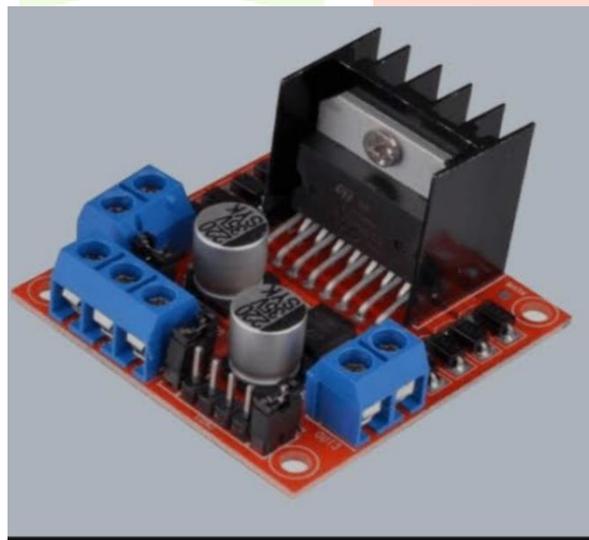


Fig. 3: Motor Driver

[III] BO (BATTERY OPERATED) MOTOR:

- BO motor (Battery Operated) lightweight DC geared motor which gives good torque and rpm at lower voltages
- Here you can get BO motor with varying rated speed
- This motor can run at approximately 200 rpm when driven by a single Li-Ion cell
- Great for battery operated lightweight robots



Fig. 4: BO Motor

VI. HARDWARE DESIGN:**COMPONENTS COMPARISON AND SELECTION:**

- **MICROCONTROLLER COMPARISON:**

| Sr, No. | Component | Options | Advantage | Disadvantage | Choice |
|---------|-----------------|--------------|---|--|--------|
| 1 | Microcontroller | Arduino Mini | 14 Digital I/O pins. 4 Analogy I/O pins. 6 PWM pins. 18*33mm Size. | Power socket is not available No program burn compatibility | NO |
| | | Arduino Nano | 14 Digital I/O pins. <u>8 Analogy I/O pins.</u> 6 PWM pins. 18 *45mm Size. program burn connector is available. | Power socket is not available. | YES |
| | | Arduino Uno | 14 Digital I/O pins. 6 Analog I/O pins. 6 PWM pins. 54*66 mm Size. program burn connector is available. | 54*66 mm Size | NO |

| | | | | | |
|--|--|--------------|--|-----------------|----|
| | | Arduino Mega | 50 Digital I/O pins. 16 Analog I/O pins. 12 PWM pins. 101* 50mm Size. Program burn connector is available. | 101* 50mm Size. | NO |
|--|--|--------------|--|-----------------|----|

• **MOTOR DRIVER COMPARISON:**

| Sr. No. | Component | Options | Advantage | Disadvantage | Choice |
|---------|--------------|---------|---|---|--------|
| 1. | Motor Driver | L293D | Provide 1.5 A per channel compact design | less current handling No heat Sink no protection diodes no voltage regulator IC | NO |
| | | L298 | Provide 2 A per channel On board Voltage regulator Heat sink is attached Protection diodes are available | L298 is Bigger in size than L293d motor driver | YES |

VII. SOFTWARE DESIGN:

[I] Arduino IDE:

- The arduino Integrated Development Environment (IDE) is used to program our Arduino Nano
- This software is contained with series of menus, text consoles, text editors for writing code and a message area

[II] Bluetooth Electronics:

- It is an android application that allows users to use their device to control any other existing android device
- You can use the Bluetooth controller to make your Android phone/tablet work as a gamepad to play games on emulators available on android operating system
- However, you need to install Bluetooth controller on both devices for the app to work
- One is the host device and other one is the controller

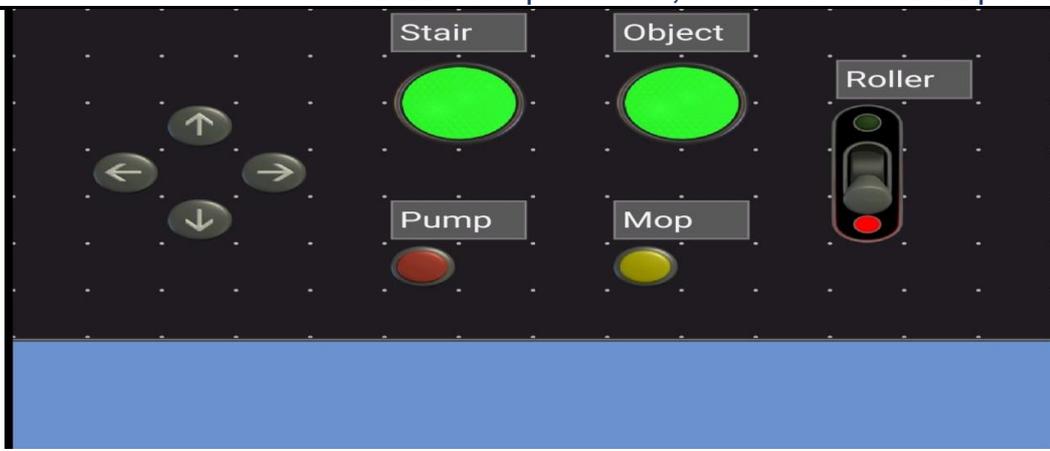


Fig. 5: Remote Designed on Bluetooth electronics IDE for Android

VIII. CONCLUSION AND FUTURE SCOPE:

[I] CONCLUSION:

- Successfully, the cleaning bot is operated through a Smartphone via Bluetooth by a user. As soon as any depth or obstacle is detected then this information is sent to the Arduino Nano i.e. the microcontroller of our project. This activity immediately stops the robot for further movement and information is sent to the user on his Smartphone regarding the depth or obstacle accordingly.
- Secondly, if the surface is dry, a pump is attached at the front, pumps water on the wet mop. Instructions of operation of this pump are given by the user operating through the Smartphone. Two motors at the front of the robot are attached with a spongy cloth, altogether acting as the wet mop.
- Thirdly, a drying mop is attached at the back of the robot, which is only used when required to increase the efficiency of the robot. This function is performed by a servomotor which either lifts or drops this mop as per the utilization required by the user/operator. The servomotor is attached to the Arduino Nano and operated by user using a Smartphone via Bluetooth.



Fig. 6: Complete Working Model of the Hardware

[II] FUTURE SCOPE:

As we have mentioned before, people in the urban areas have hours of work load. That is the reason people look new ways to manage time and save it. Some of the advancements that can be done are mentioned below:

- This system can be adopted for domestic appliances
- PLC can be added for monitoring and operating the system
- We have serious dust and pollen problems around the world, quite many people fall ill due to these reasons. This device can further be modified to use on roads and footpaths. This not only affects the health yet makes city/town look clean as well
- Vertical cleaning is being possible with proper technology. Buildings and walls can be cleaned off with such Machine

IX. REFERENCES:

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