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Smart Cleaning and Sanitization Robot Using Arduino Uno

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ABSTRACT: Now a days due to this covid-19 situation all peoples understanding importance of Hygiene and in real this was very worst but we can fight against it. As we know when someone come in contact with that viruses that person get infected. We can avoid it by staying in home but what about doctors, workers in hospitals. They have to play there role any how so by considering this all we developed a bot which can clean rooms floors as well as bot sanitize rooms also and its completely automatic. So without any human interference we can clean hospitals, homes etc. so there is lesser chances of getting infected. This paper presents the design, development and fabrication of prototype automatic bot "Mr. clean-X" is an automated machine that facilitates the user cleaning and sanitization.

KEYWORDS: Automatic Cleaner, Sanitization, Arduino Uno, Vacuum Cleaner, Automation.

I. INTRODUCTION

Mr. Clean-x (Smart Cleaning and Sanitization Robot Using Arduino Uno) has been manly designed for hospitals, offices, homes also in collages. In this project, we are designing a fully automatic floor cleaner using arduino uno, motor driver, ultrasonic sensor, motors, pump, vacuum and UV light lamp. In which ultrasonic sensor is used for obstacle avoiding purpose. All components are connected to Arduino uno which controls all process. With the aim of keeping our robot as simple as possible, while able to perform the initial goals, i.e. cleaning and sanitization of rooms by using vacuum, sanitizer spray and UV light inbuilt in it. This robot is not only going to clean floor by just sucking dust and dirt particle but also it going to sanitize and most important thing other similar product in market which perform only job of cleaning dirt that also very costly but this bot is made with very low budget due to its simplicity. Now a days this types of robots are needed.

II. LITERATURE REVIEW

In our daily life we are using various products for the cleaning purpose like vacuum cleaner. But now a day's all things going towards the automation. Robotics and automation is changing our lifestyle and cleaning sector is also impacted by this.

1) Automation in robotics

Automation is the thing which completely changing everything. In robotics automation is there, in automation things happens automatically without any human interference. Robots programed like that they sense the conditions in environment and act accordingly to it.

2) Robots in Cleaning

Now a days we saw many robots are used in many areas for performing various task and robots are used to floor cleaning as well as other cleaning stuff, some robots uses vacuum cleaner concept for cleaning that collects dust and dirt by suction. many but that robots are limited scope means that are not multitasking just they clean dust like stuff from floor or now a days some of them are using advance technologies also like

mapping techniques. Some of example of it 'Roomba' robot but that robots are very costly everyone can't afford it and from this corona pandemic robots are playing major roles in cleaning.

Here is little chronological order how the robots in cleaning evolved and still how evolving:

- In 1956, the American science fiction author Robert A. Heinlein coined the concept of a robotic vacuum cleaner he calls it as 'Hired Girl' robot and he mentioned this in his novel 'The Door into summer'. Basically it was just a better vacuum cleaner in that days [1].
- In 1990, three roboticists, Colin Angle, Helen Greiner and Rodney Brooks founded iRobot. It was originally dedicated to making robots for military use as well as domestic use. In 2002, it introduced the Roomba, a vacuum cleaner that could detect obstacles, detect dirt and dust on the floor, and detect steep drops to prevent it from falling down stairs. Roomba, Braava, and other autonomous cleaning equipment are among the company's offerings [2].
- In 1996, Electrolux introduced the first 'Robotic Vacuum Cleaner', the 'Trilobite' It performed effectively, although it had a habit of clashing with objects and stopping short of walls and other objects, as well as not cleaning small areas. As a result, it was withdrawn after failing on the market. In the year 1997[3].
- The Neato Robotics XV-11 robotic vacuum launched laser-based mapping in 2010, allowing travel in straight lines rather than random patterns [4].

III. METHODOLOGY

The basic block diagram for the implementation of the project is as shown in figure 1. Which representing all connections overview.

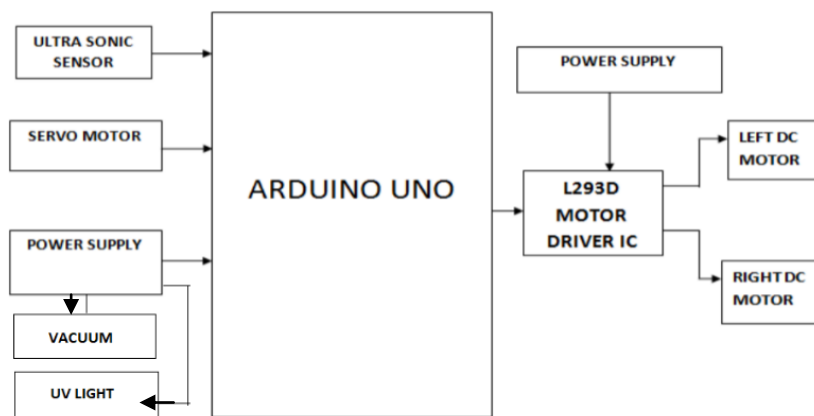


Figure 1: Block Diagram of the system

When we switch on the robot, vacuum and UV light switched on and the Ultra sonic sensor which is mounted on servo motor it going to transmit signals and whenever it detect obstacle in front of robot that signals strike on obstacle and received back as by sensor so by considering time factor it going to determine distance from obstacle if its less than our given range that time it change its direction of moving. Firstly user initialize trigger and echo pin as low and push the robot in forward direction and when obstacle is detected echo pin will give input as high to microcontroller. After determining the time, it converts into a distance. If the distance of object is moderate then speed of robot get reduced and will take left turn, If obstacle is present in left side then it will take right turn and if all sides obstacle is present it take backward that's moving strategy of robot.

Arduino board is connected with DC Motor through Motor driver (pin10, pin11, pin12, pin13) which provides power to the actuators. Actuators are used to move robot in Left, Right, Forward and Backward, directions. The simple description of inputs pins for movements of robot is as per given table. Robot stops when it detects obstacle and then ultrasonic sensors give time in length to the microcontroller as an input for further movements. Here we using obstacle avoiding robot concept [6].

Table 1: Input pins for movement

Movement	Pin10	Pin11	Pin 12	Pin 13
Forward	1	0	0	1
Backward	0	1	1	0
Left	1	0	1	0
Right	0	1	0	1

A) Sensors for obstacle detection

Large varieties of sensors are available now which can be used for the detection of obstacles some of the very popular sensors are like Infrared sensors (IR), Ultrasonic sensors. We are using ultrasonic sensors for the detecting and avoiding obstacles and most important it's not going to be affected by sunlight or others type of light. The ultrasonic sensors continuously transmit the frequency signals, when obstacle is detected this signals are get back towards sensor which then considered as input to the sensors echo pin. HC-SR04 ultrasonic sensor consist of 4 pins VCC, Trigger, Echo and GND.

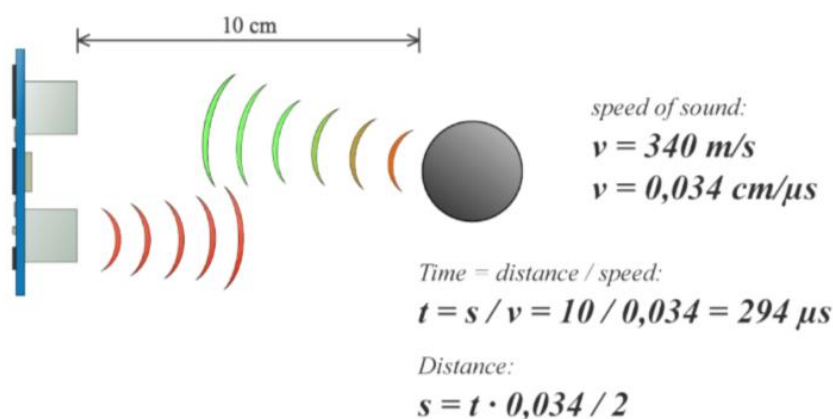


Figure 2: Ultrasonic Sensor – Working and Calculation

For example, if the object is 10 cm away from the sensor and the sound speed is 340 m/s (0.034 cm/s), the sound wave must travel for approximately 294 μs. However, because the sound wave must go forth and backward, we will get twice that amount from the echo pin. So, to determine the distance in cm, multiply the received trip time value by the 0.034 and divide by 2 as shown above figure.

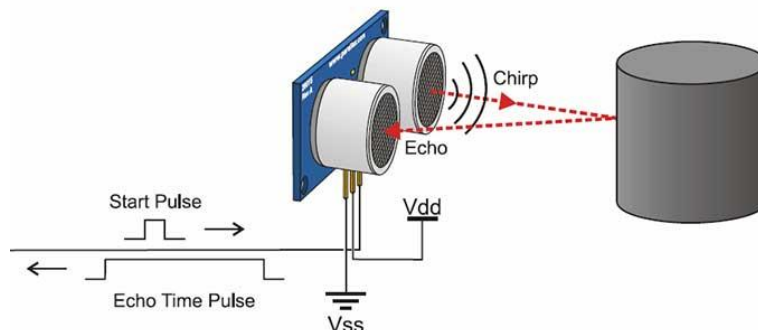


Figure 3: Ultrasonic Sensor working

A multi vibrator is attached at the base of the sensor. The ultrasonic waves created by vibration are delivered to the resonator by the multi vibrator, which is a combination of a resonator and a vibrator. The emitter, which emits a 40 kHz sound waves and the detector which going to detect the 40 kHz sound waves which is reflected from obstacle sends electrical signal back to the microcontroller.

Features of Ultrasonic Sensor:

1. Light weight
2. High accuracy
3. No impact of sun light
4. Power consumption of 20mA
5. Narrow acceptance angle

B) Flowchart

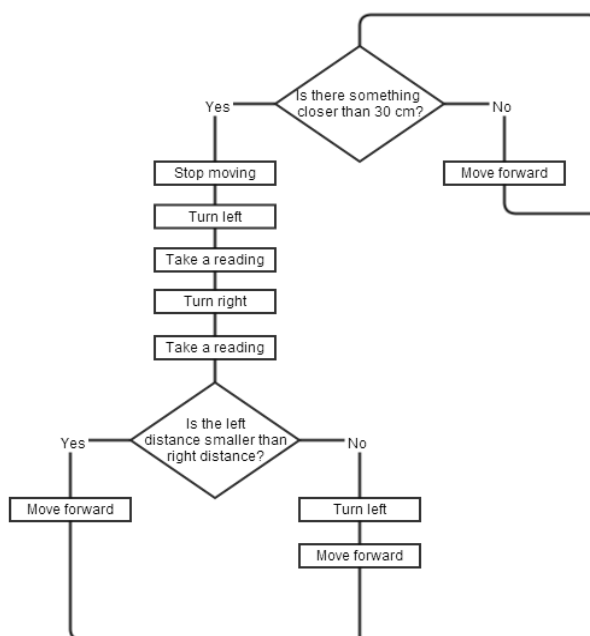


Figure 4: Flow chart for avoiding obstacles

Flow Chart of the working of the Mr. Clean-X robot. Initially it checks obstacle within 30cm. If there is an obstacle it stops moving in forward direction and turns towards left and checks if there is an object closer than 30 cm. The check this condition which have two possible results yes or no. Yes, means that there is some object closer than 30 cm. and No, means that there is no objects present within 30cm. If there is nothing within 30 cm the robot can simply move forward direction as in programming. If there is something closer than 30 cm then the first stage of obstacle avoiding is to stop the robot. After the robot has stopped it needs to see which side it should go. It do this by looking at both sides, like we look while crossing the roads. First the robot turns left and takes a reading, turns right and takes a reading. Another check done to see what direction is good for moving means no obstacle. if left distance smaller than right then move forward if no then it take turn left and moves in forward direction and this all loop repeated again and again until room is get cleaned and sanitized.

C) Implementation

This robot basically has two modes of working that are:

1) Dust clean mode.

In This Mode bot will collect all the dust particles from floor which is 1st step of cleaning.

2) Sanitization mode.

In this mode bot sprays sanitizer liquid on floor and also UV lights[5] also plays their role of killing bacteria and viruses.

Here are some photos of 'Mr.Clean-X' robot :



Figure 5: Vacuum in dust clean mode

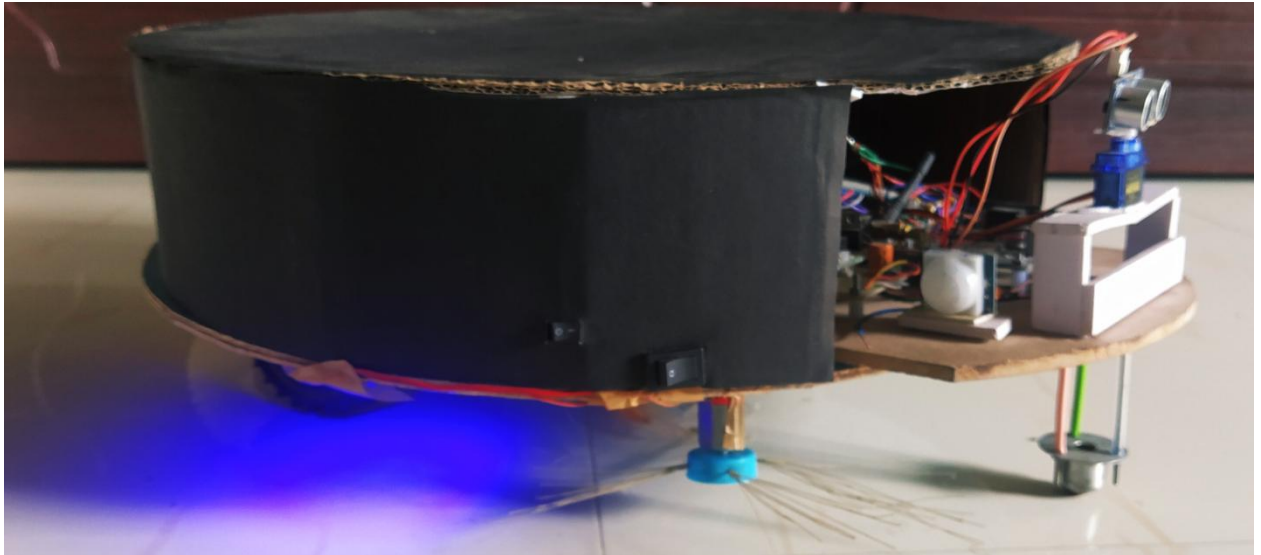


Figure 6: Sanitization by UV light and sanitizer spray

IV. RESULTS AND DISCUSSION

The results we obtained is that “Mr. Clean-X” robot made using arduino is multifunction robot.

Moves in forward direction by collecting dust and cleaning dirt from floor. If any obstacle detected by ultrasonic sensor it changes its direction. At the end after few time it cleaned room completely. In sanitization mode also performing same just that time vacuum is switched off and UV light and sanitizer spray is working that’s how robot cleaned and sanitized room completely.

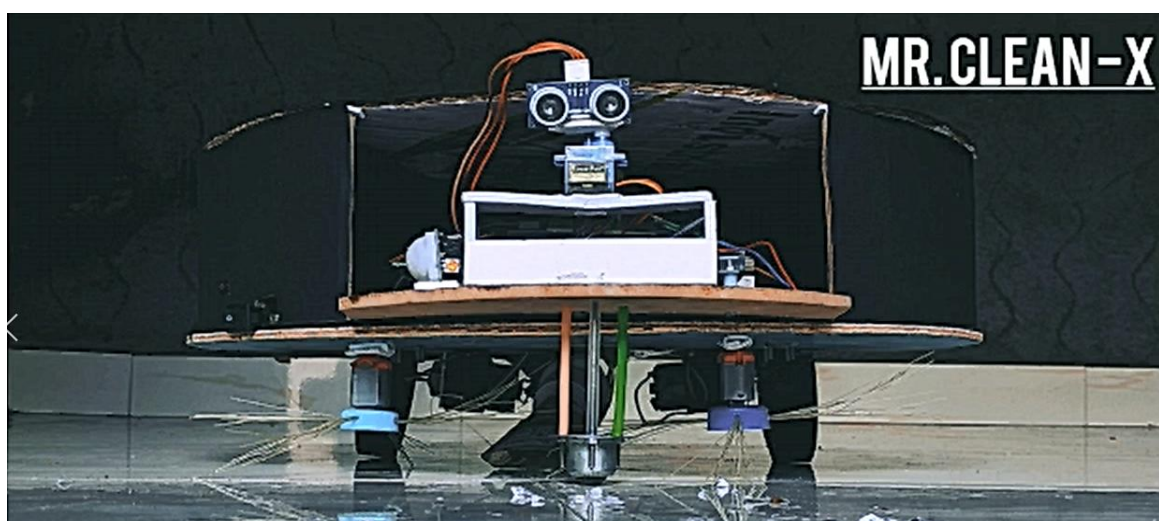


Figure 7: Result of Project



V. CONCLUSION

“Mr. Clean-X” robot that multifunction robot which performs task like cleaning floor as well as it sanitize rooms also and this is all done without any human interference. Means there is less chances of getting affected due to viruses like covid-19 and other fungal infections also. That days we need that type of devices for cleaning purpose.

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