

Automatic Toilet Bowl Cleaner

Ashwini Patil¹, Rutuja Patil², Snehal Phalke³, Prof.S.T.Khot⁴

^{1,2,3}Students of Bharati Vidyapeeth's College of Engineering for Women, Pune, India.

⁴Professor at Bharati Vidyapeeth's College of Engineering for Women

Abstract- Moving towards our glorious goal of developed and prosperous nation, cleanliness is one of the biggest need. 'Swachh Bharat Abhiyan' is our motto behind the research of 'Automatic Toilet bowl Cleaner' and it is the great leap towards the cleanliness of private as well as Public Lavatories. Dirty toilets cause contagious diseases which are hazardous for human life. This system is a remedy for human health as well as our goal towards 'clean and smart India'. The purpose of this system is to maintain hygiene level of toilets through cleaning the bowl in a semi automatic way. At present, cleaning system of toilets is worst and leads to health issues. This system automatically cleans the western toilet with the help of robotic arms. There is a sequential cleaning algorithm for the same.

The robotic arm has a brush attached to its end that is used for the cleaning purpose. Water jets are provided. In this system there is minimum usage of water & electricity. To maintain the periodicity of cleanliness level servo motor and DC motors are used. Very few attempts are done to figure out the machine required for cleaning the lavatories. The advantages of the system are that it reduces the labour work and its working is flexible. It is affordable for consumers for its implementation.

Keywords- Cleanliness, Toilet, Sequential cleaning algorithm, Robotic Arm.

I. INTRODUCTION

In today's world, hygiene in public lavatories is most important aspect in urban sanitation. There is no other cleaning system for cleaning of lavatories than by doing it manually, which requires lot of human efforts and still have more possibility of spreading the contagious diseases which are very dangerous and even fatal. This system has been designed from the point of view of eliminating the efforts for such cumbersome jobs that a human does.

For fulfilling the idea of cleaning the lavatory in a semi automatic way, robotic arms are implemented that clean the bowl of the toilet. Moreover the cleaning agent is present in the flush tank itself, thus there is no need of adding any external cleaning agent to the process that will be going on. The programming has been done in the Embedded C language.

II. LITERATURE SURVEY

It is understood from the literature survey that there is very less existing technology for automatic cleaning of toilets. As mentioned by *E.Elakiya, K.Elavarasi et al[1]*, The washing and cleaning facility for public toilets in schools, colleges, offices and public places take place automatically using various sensors like RFID sensor, Infrared sensor, sonic sensor sensor, smell sensor etc. The cleaning of the toilets can be

done automatically by detecting dirt. As there are various sensors used, the system is not cost effective. This is the biggest disadvantage of the system. [1]

According to second paper, *K. Karthikeyan et al[2]*, Cleaning of railway lavatories is possible using the mechanism of Automatic Lavatory Cleaning System(ALCS). This is advanced architecture using the different microcontroller like PIC16F877x. Each operation is needed to be performed using various steps. This system proves very useful in the railway toilets. It is also applicable for Indian Toilets but require manual interference. As mentioned above this system is only for cleaning the lavatory. Moreover this system is flexible only for the public toilets as the capital involved is reasonable for the government and can be used for number of toilets, but the domestic use of this machine is not possible as the expense is high for common people.[2]

Literature survey reveals that very less research is done in this area and there is earnest need to reduce human efforts. The developed system consists os a bowl cleaner that not only cleans but also makes it hygienic; as it consists of liquid disinfectant that leads to hygienic lavatories. The advantages of the proposed system are as: It can reduce human efforts, protect human beings from harmful & contagious diseases, can reduce the foul smell in toilets and finally it would maintain the quality of toilet cleaning. The cleaning results would be completely dependent on the user, how the periodicity is maintained by them. This is also cost effective as compared to the system mentioned in the above two papers of literature survey[1].

III. METHODOLOGY

A. PROCESS PLAN AND FABRICATION OF ROBOTIC ARM

The system cleans the bowl of the toilet with the help of robotic arms. There is a cleaning algorithm that works in a specific order. The horizontal robotic arm has a brush attached to its end and is used for the cleaning purpose. In this system there is less use of water & electricity. There is a push button provided for the user to operate the mechanism. The function of horizontal robotic arm is to rotate in clockwise as well as counter clockwise direction and vertical arm has to rotate in upward and downward direction. To maintain the periodicity of cleanliness level, press button is provided.

The components required to make the mechanical assembly of robotic arms are T shaped metal plate, two DC motors, L293D, all connected to the Arduino controller. The metal arms are fixed but there is a hydraulic mechanism that provides the flexibility to the Robotic arms to rotate in vertical as well as circular direction. The robotic arms are controlled by two dc motors of 15 RPM and 100 RPM respectively. The

motors are fixed with the help of DC motor brackets. DC motors control linear as well circular motion of the arms and thus movement of the arms begin and cleaning operation takes place immediately[3].

The final step is to flush the toilet automatically by using the servomotor that is mounted on the flush tank. This motor helps to pull the flush button down and clean the lavatory in the last flush.

Hardware Interface:

1] Arduino UNO description-

- Controller IC ATmega328P
- Operating Voltage 5V
- Crystal Frequency 16MHz
- 28 pin IC
- DC output 5V
- DC current 30-40mA

2] Motor driver IC specifications L293D-

- 16 PIN IC
- Two motors can be interfaced simultaneously

3] DC motors specifications -

- RPM: 30.
- Operating Voltage: 12V DC
- Gearbox: Attached Plastic (spur)Gearbox
- Shaft diameter: 6mm with internal hole
- Torque: 2 kg/cm
- No-load current = 60 mA (Max)
- Load current = 300 mA (Max).

4] Relay Module - 1 Channel - 5V - High Level Triggered-

- Relay operating voltage:10A 250VAC / 10A 30VDC
- Trigger logic level: High level triggered
- Trigger Voltage:+5VDC

5] AC Pump description -

- 230V , 0.5A

Software Interface:

- Arduino IDE 1.6.13

B. DETAILED WORKING

The programming of the system is done in the Arduino software and embedded C language. ATmega 328p IC is used for this purpose. There is another IC that is used in this system and that is L293D (also known as motor driver IC). This is used to drive three DC motors in general but for this system, it is used for driving two DC motors simultaneously. The basic working can be explained as below[3].

The first step to begin with the cleaning is to fit the machine on the toilet bowl. Then press the START button that is provided on the board. As soon as the button is pressed, the working of the cleaner begins. The vertical arm rotates in downward motion and horizontal arm rotates in clockwise direction. Then it stops and moves downward again rotates in counter clockwise direction. These steps repeat themselves for three times. There is a water stream jet that is used to throw water on the arm for cleaning purpose. The main advantage of using this stream jet is, the water required for cleaning the bowl is less as compared to the water requirement in manual cleaning.

IV. SYSTEM ARCHITECHTURE

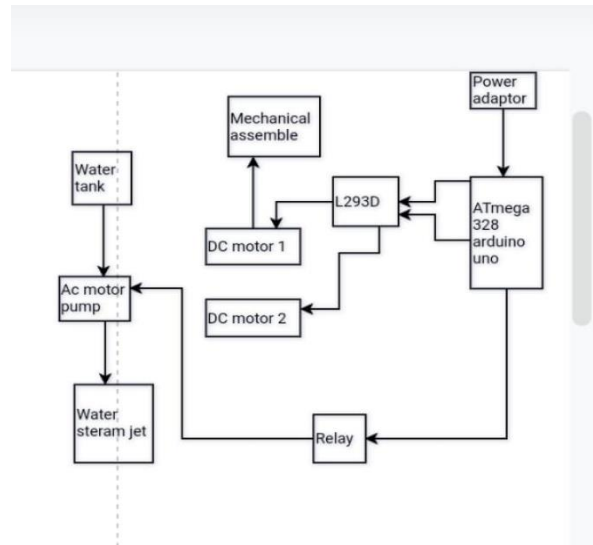


Fig.1: Block Diagram of the system

- Automatic toilet bowl cleaner is based on the Arduino Uno platform which acts as the semi automatic cleaner for the lavatories.
- A power adaptor is used to provide the supply to the actual circuitry.
- When the input is provided to the Arduino, it receives the command of driving the motors with the help of motor driver IC.
- One motor will rotate the arm in vertical direction second motor rotates the horizontal arm in the circular direction.
- A relay is used to turn on the AC pump which throws the water on the brush to clean it up and water tank is provided to supply the water to the pump.
- The brush will be cleaning the pot approximately for upto 50 seconds.

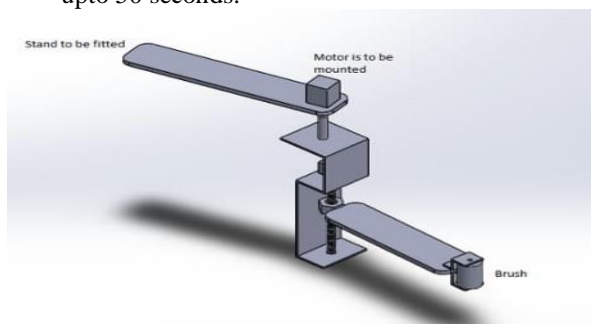


Fig.2: Robotic arm Design

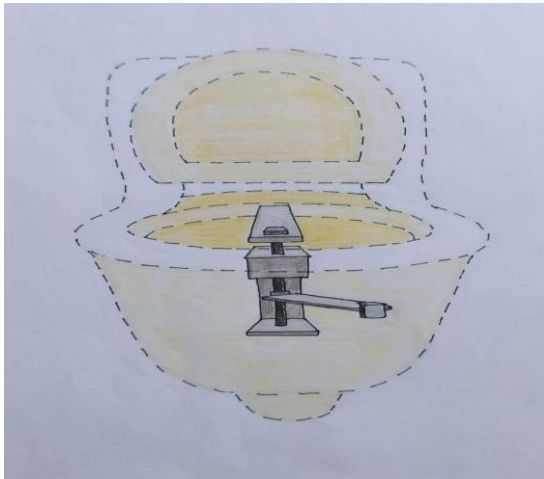
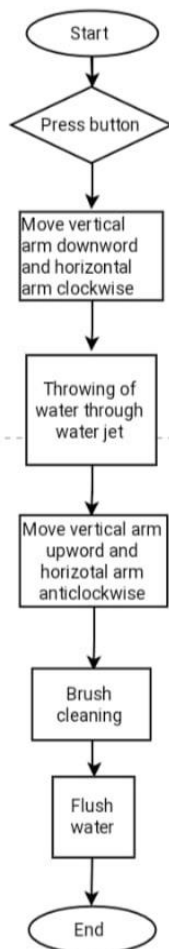


Fig.3: Overlook of the system

V. FLOWDIAGRAM



VI. FLOWCHART DESCRIPTION

- Fit the machine on the bowl for cleaning.
- Press the button to start the cleaning.
- Then the motor will rotate the arm in clockwise downward direction. At that moment the bowl gets

cleaned once in circular motion.

- Direction of the motor gets reversed and bowl gets cleaned in the anticlockwise motion.
- Simultaneously, water is thrown on the brush to clean the bowl.
- At last, the brush gets cleaned and the motor stops.
- Servo motor rotates 180° for automatic flushing.

VII. INDUSTRIAL APPLICATION

This technology offers a 'clean on demand' model, allowing housekeeping department to deploy their manpower resources more efficiently. It can also be used for domestic purposes also. It can reduce the human efforts by semi automatic cleaning. It allows better maintenance and hygiene level of toilets and set a higher standard of cleanliness of the toilets. It is also a convenient way of obtaining relevant real time information on usage and odour levels in toilets. This system is economical and easy to implement in the existing toilets.

VIII. CONCLUSION

In this paper, automatic toilet bowl cleaner is presented that cleans the toilet bowl with very less human interference. It will help human beings with semi automatic cleaning. The Robotic arms are used for cleaning the toilet and liquid stream jet is provided which will maintain hygiene and clean environment in toilet. Many hazardous and contagious diseases can be prevented. In future, different sensors will be used to make the system fully automatic

IX. RESULTS



X. ACKNOWLEDGEMENT

We would like to acknowledge all the people who have been of the help and assisted us throughout our project work. First of all we would like to thank our respected guide **Prof. S.T. Khot**, Professor in Department of Electronics and Telecommunication Engineering for introducing us throughout features needed. The time-to-time guidance, encouragement, and valuable suggestions received from her are unforgettable in our life. This work would not have been possible without the enthusiastic response, insight, and new ideas from her. The acknowledgement would be incomplete without mention of the blessing of the Almighty, which helped us in keeping high moral during most difficult period.

XI. REFERENCES

- [1]. E.Elakiya, K.Elavarasi, Mrs.R.P.Kaaviya priya, "*Implementation of smart Toilet (swachh shithouse) using IOT embedded sensor devices* " International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) Vol. 5, Special Issue 9, March 2018.
- [2]. S.M. Ashiq. K. Karthikeyan, S. Karthikeyan (2013, Feb.). "*Electrical Fabrication of Semi-Automated Pressurized Flushing System in Indian Railway Toilet.*" International Journal of Engineering and Advanced Technology (IJEAT).
- [3]. Yusuf Abdullahi Badamasi, "*The Working Principle Of An Arduino*" 2014 IEEE Conference.
- [4]. Chien-Wei Chen, Rui-Ming Hong, Hung-Yu Wang, "*Design of a controlled robotic arm*", 2016 3rd International Conference on Green Technology and Sustainable Development.
- [5]. Anil C. Gawande, Shivani Telrandhe ,Ashwin Satone, Prasad Kade, "*Design And Fabrication of Advanced Mechanism for Indian Toilet Dome Cleaning with Multi Washer's Assembly*" International Journal of Research in Advent Technology, Vol.6, No.4, April 2018.