

# Self Regulated Deodorizing Lavatory System

K. Hemalatha, S. Sivajothi Kavitha, D. Usha

**Abstract:** The introduction of integrated robotics in the field of sanitation is the main motto of our project. In this paper, we have implemented a new idea of integrating a robot named Auto end-effector or which is used for improving the sanitation, efficiency and convenience of the cleaning process in the public lavatory systems. In the proposed system called Self-Regulated Deodorizing Lavatory System, a counter is used to record the number of times of usage of the lavatory system and initiates the cleaning process. Similarly a sensor module detects the sanitation level and the cleaning process is continued which is performed by a robotic arm called Auto end-effector. Thus SRDLS system will greatly eliminate the role of manpower in the maintenance of public lavatory system to a greater elevation and facilitate the preservation of hygienic standards.

**Keywords:** Self-Regulated Deodorizing Lavatory System (SRDLS), Auto End-effector, Lavatory Systems, Sanitation, Hygienic Standards.

## I. INTRODUCTION

Sanitation is of prime importance in today's society. More than 1000 children die every day in the country from diarrhea. The majorities of diarrheal deaths are caused by poor sanitation and hygiene that affect the people using public lavatory system. Human excreta, among all forms of wastes, are the principal sources of many enteric diseases and almost cause 80% of the diseases in developing countries. Studies reveal that over 50 types of infections can be transmitted from human excreta. As our honorable prime minister Narendra Modi launches an act of "Swachh Bharat Abhiyan 2017" to "Clean India", there are many efforts taken by the central government of India to maintain the sanitary standard of our nation. The main motto of our project is to maintain and improve the sanitary level for people using the public lavatory system and to make the cleaning process unmanned. The existing Autonomous lavatory cleaning system is intended for western public lavatory system only and it cannot be implemented all over India since our country is a developing country and only Indian type lavatory system is used widely. So this proposed system facilitate ease of operation, power Requirements and financial effectiveness will lead to a much practically realizable system.

## II. SELF REGULATED DEODORIZING LAVATORY SYSTEM

Our proposed project mainly focuses on automating the cleaning process in the public lavatory system and to reduce the human effort. It aids to improve the hygienic level and maintain the sanitary standards in the public lavatories at rural and urban areas. By implementing this system the water

level required for cleaning purpose in the public lavatories can be conserved. The block diagram of the SRDLS system is given below

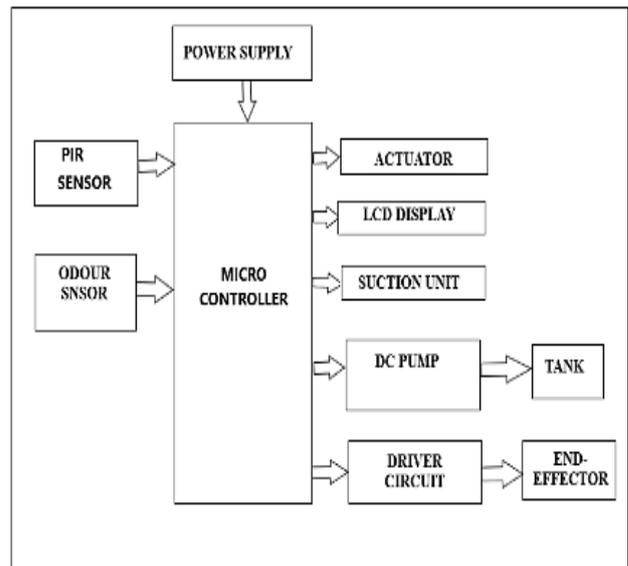


Fig 1: Block diagram of SRDLS

To execute the unmanned cleaning of the lavatory system, first the number of times of usage is counted using a counter and the absence of the human is sensed and automatically latches the door and initiates the cleaning process informing the public that cleaning is in process. Then using odour sensor the ammonia level is sensed and cleaning is proceeded. Any unwanted obstacles present are collected using the suction unit and self-deodorizing unit is operated for predefined time. After the self-deodorizing unit the brush holding Auto end-effector is initiated and cleaning is performed. Thus the cleaning process is executed.

## III. HARDWARE IMPLEMENTATION

### A. Sensor Section

#### PIR Sensor

PIR sensor detects a human being present inside within the lavatory system approximately 10m from the sensor. The PIR sensor is a pyro electric sensor, which can detect levels of infrared radiation. This is used in this project to count the number of times of usage of the lavatory by discovering when an individual has entered and left the lavatory system PIR sensors are simple to interface with the microcontrollers. It has a 3-pin connection at the bottom. One pin will be ground, another will be signal and the last pin will be power. A 5V Power supply is given from the microcontroller.

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K. Hemalatha, Assistant Professor, Dept of EIE, Jerusalem College of Engineering, Chennai, Tamilnadu, India.

S. Sivajothi Kavitha, Assistant Professor, Dept of EIE, Jerusalem College of Engineering, Chennai, Tamilnadu, India.

D. Usha, Assistant Professor, Dept of EIE, Jerusalem College of Engineering, Chennai, Tamilnadu, India.

## Self Regulated Deodorizing Lavatory System

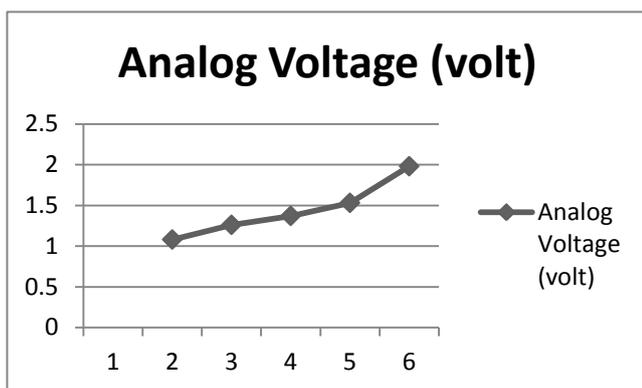
Thus the Passive Infrared Sensor is used to sense the presence of persons inside the lavatory system and the door is closed automatically after the counter preset value is reached.

### *ODOUR Sensor*

The Odour sensor detects the ammonia level present in the human excretion in the lavatory system. MQ135 semiconductor gas sensor is used in this system for detecting the ammonia content. The detection range of MQ135 is 10-300ppm. The sensor works on the principle that, when there is an interaction between ammonia gas and sensor, the ammonia gas gets ionized and is then adsorbed by the sensing element. This sensing element is housed under a steel exoskeleton and is subjected to current through the leads. Due to ionization of ammonia and adsorption by sensing element, there is a change in resistance of the sensing element, which changes the value of the current going out of it. So, from the gas sensor we get the output in the form of analog voltage that is converted to digital since the microcontroller has inbuilt ADC. The sensor module works on +5V DC supply.

**Table 1: Concentration of liquid Ammonia level**

Concentration of liquid ammonia	Analog Voltage
1gm	1.08V
2gm	1.26V
3gm	1.37V
4gm	1.53V
5gm	1.98V



**Graph 1: Output voltage**

### *B. Mechanical Section*

#### *i) Suction Unit*

The suction unit drags the unwanted obstacles present inside the lavatory system through a suction nozzle with compressed air and all the dust is collected.

#### *ii) DC Pump*

The dc pump connected with the tank is used to flush the water and cleaning solution into the lavatory for cleaning. It runs at 100-200rpm and requires 12V supply voltage.

#### *iii) Auto End-Effector*

The Auto End-Effector is a prototype of the robotic arm used for holding the brush and activating the cleaning process. The cleaning process proceeded as explained below,

1. The wall of the lavatory system is automatically flushed with the help of a DC pump connected with the water tank for a pre-set time.
2. The arm containing the brush is lowered with the help of a 12V DC motor.
3. A cleaning liquid is dispensed in the wall of closet using DC pump for a pre-set time and the axle containing the brush is rotated using motor to perform cleaning. This action happens for 35 seconds.
4. After 35 seconds the brush is removed and again flushed with water.
5. Again the brush is lowered and rotated for 25 seconds for thorough cleaning.
6. After 25 seconds, the brush is removed and water is flushed again.

Thus after completion of these six steps, the LCD display indicates the end of cleaning process and the door is unlocked automatically.

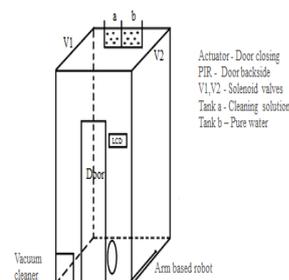
#### *iv) LCD Display*

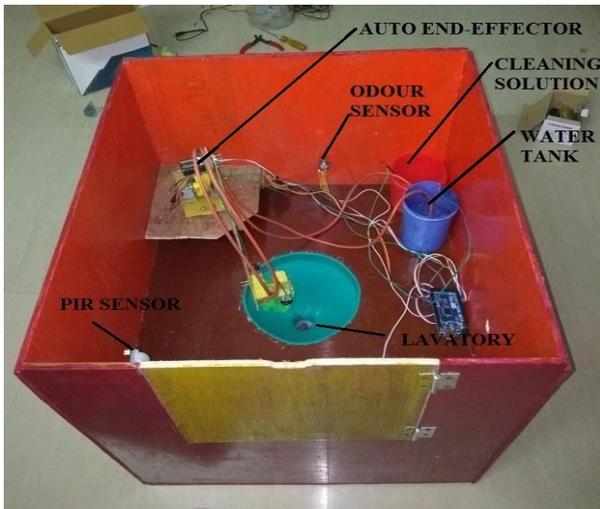
LCD (Liquid Crystal Display) screen is an electronic display module used for indication of commands such as “cleaning is on process”, “process completed successfully” and “timing of the process” is displayed.

### *C. Controller Section*

In this system the Arduino Mega 2560 microcontroller is used. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply it is connected to a computer with a USB cable or powers it with a AC-to-DC adapter or battery to get started. It can be programmed with the Arduino software. The Atmega2560 on the Arduino Mega comes pre-burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

## IV. WORKING MODEL





## V. CONCLUSION

The Self -Regulated Deodorizing Lavatory System proposed can greatly eliminate the scope of manual labor involved in the process of maintaining sanitary standards. While cities moving towards solutions which can diminish the existing problems in cleaning public lavatories. It can be installed for cleaning toilets in households, public restrooms and restrooms in malls, stadiums, supermarkets etc.,. Furthermore, it can be used for upholding standards of hygiene in trains, where it bears prime importance. The growing emphasis on smart cities and environment friendly alternatives necessitate a technologically competent means of combating the problem of cleaning restrooms. This Self-Regulated Deodorizing Lavatory System seeks to achieve exactly the same. The system is more eco-friendly as well as having fully automatic operation. The installation cost and time required for installing this system are very less.

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