SMART LAVATORY WITH AUTOMATIC CLEANSING SYSTEM AND LIVE HYGIENE MAINTENANCE FOR PUBLIC

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Abstract- *In this research paper pertaining to smart lavatory automatic flushing in the toilet seat is implemented using Gear motor and power supply to the motor is fed from the motor driver. This work makes use of a money slot system and an occupancy detector such as. Passive infra red (PIR) sensor that can have automatic control over the lavatory doors. Here, whenever the coin is inserted into the coin box, PIR sensor checks whether any person is present inside the cubicle or not. If nobody is inside the cubicle the door will be opened, otherwise the door will be in the locked state. After the usage, in order to open the door the user has to press the button which is inside the cubicle so that the toilet seat is flushed automatically and the door is made open. The cleanliness of the toilet is monitored with an odor sensor in which ammonia and hydrogen sulphide is measured that causes bad odor in the toilets. If the cleanliness level is below the threshold then the toilet seat and floor of the rest room is cleaned automatically by using pressurized water, which is then followed by pressurized air for drying and also some room perfume is sprayed. The cleanliness of the whole lavatory is measured and rated automatically on the basis of cleanliness level measured by the odour sensor. This automated rating is updated in the cloud and whenever the user locates the toilet using Google map the rating of the particular restroom is viewed and hence cleanliness of the toilet by curtailing the man power and conserving the water from abundant usage of water for flushing and floor cleaning in lavatories for making it a health sanitary scenario.*

*Key Words***: Integrated Development Environment (IDE),**

Liquid Crystal Display (LCD), Microcontroller Unit (MCU), Passive Infrared (PIR), Radio Frequency Identification (RFID), Solid and Liquid Waste Management, Infra Red (IR).

1. INTRODUCTION

A comfort station may be a room or small building with one or more toilets (or urinals) available to be used by the overall public, or by customers or employees of a business. Mostly Public toilets are commonly female facilities although some are unisex, especially for little or single-occupancy public toilets. Increasingly, toilets are also for people with disabilities. Public toilets are known by many other names counting on the country. Some public toilets are freed from charge while others charge a fee. In the latter case they're also called pay toilets and sometimes have a coin-operated turnstile. Local authorities or commercial businesses may provide comfort station facilities. Some toilets are unattended while others are staffed by a janitor or an attendant. Public toilets are typically found in schools, offices, factories, and other places of labor. Similarly, museums, cinemas, bars, restaurants, entertainment venues and many other places usually provide public toilets.

2. NEED FOR SMART LAVATORIES

On implementing the smart lavatories the cleanliness of the rest room is ensured every time, the user leaves the restroom after use. Even the cleanliness level is monitored keenly and rated so that the travelers who are new to the place can use the restrooms by knowing the cleanliness level. On using smart toilets the bad smell felt in the restrooms are completely removed by spraying the perfumes whenever the automatic cleaning process is completed.

3. PROBLEM DEFINITION

This work addresses the problem of manually cleaning the public toilets. Though the man power is allocated to clean the toilets the man resource cannot give their full efficiency in the cleaning process. The person employed is a human, where faults are common in human life. If a person is employed in cleaning they may not be available 24x7 for the cleaning process.

4. CONTRIBUTION MADE IN THIS PAPAER

In this research work, automatic cleaning and cleanliness Monitoring systems have been contributed to the society. This proposed system is available for 24x7 to clean the lavatory whenever the toilet is unclean and the automated rating is done in order to overcome the false rating. It also cleans the toilet only when it is not clean by using pressurized water and the cubicle is dried using air and vacuum. The manual labor (Janitor) has been replaced as a token of humanity.

4.1 Objective

The major objective of their work is to develop Prototype model that can automatically Maintain cleanliness in public toilets by using an automatic flushing system, reduce labor work in the cleaning process as a sign for humanity, Conserve water by doing automatic cleaning whenever it is required, monitor the cleanliness of the toilets and to rate the toilets automatically by avoiding false rating.

5. LITERATURE REVIEW

Research work [6]proposed to periodically inspect the surface and power plants using ultrasonic sensors and visual cameras in order to prevent contamination. Robots do tasks like handling significant hot masses and acting tough repair and maintenance operations in contaminated areas. This paper investigates a robot which is guided using wireless communication by a remote location to Inspect and clean various fields effectively. [7] suggested a working robot for Floor cleaning[7]. This floor cleaner golem will add any of 2 modes which is automatic and manual and controlled by AT89S52 microcontroller. RF (Radio Frequency) modules have been used for wireless communication between remote (manual mode) and robot and having a range 50m. This robot is incorporated with IR (Infra Red) sensor for obstacle detection and automatic water sprayer pump. Four motors are used, two for cleaning, one for water pump and one for wheels. Dual relay circuit used to drive the motors one for water pump and another for cleaner. In manual mode, RF modules have been used to transmit and receive the information between remote and robot and display the information.

In the work of [8] a smart automatic urinal flushing system is proposed. It is designed and enforced to supply the usage data to a caretaker. With the sensible system, a caretaker will be able to use the usage information to estimate or to analyze the number of users in each day, or each week. It is conjointly attainable to grasp that plumbing fixtures has been used as the foremost and therefore it ought to be taken care quite the opposite ones. Only how many people use the restroom is monitored here the cleanliness of the lavatory is not monitored.

6. PROPOSED MODEL

6.1 Automatic cleaning and monitoring system

Figure 6.1.1 shows the schematic view of how the restroom appears in practical perspective. This schematic diagram contains a coin inserter near the door. Whenever the user wants to use the restroom the user needs to insert a five rupee coin into it then the toilet seat/restroom. Will be flushed and the door will be opened to use the restroom[3]. The LCD display which is connected to the coin inserter indicates the presence/ absence of the user. Whenever the lavatory is under maintenance the waiting time is displayed as a countdown in LCD display (i.e. indicator).
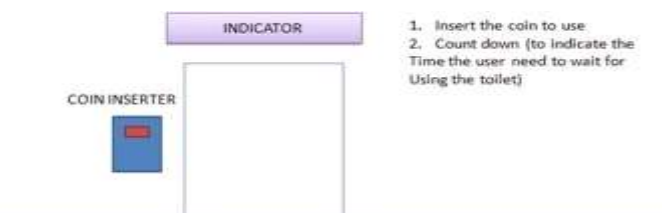

Figure 6.1.1 Front view of lavatory

Figure 6.1.2 gives the top view of the lavatory installed for automatic cleaning. Here, odour indicates occupancy detector (PIR sensor) which is used to detect the presence and absence of the user. The overall dimension of each cubicle in the public lavatory is approximately 4 feet*8 feet.
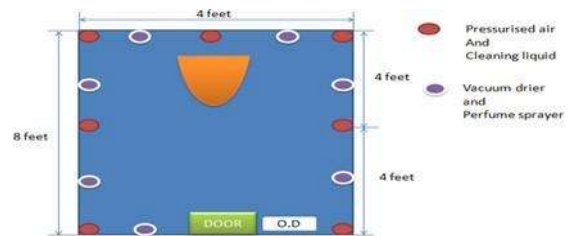

Figure 6.1.2 Top view of lavatory cub

6.2 Block Diagram

The overall system conditions are listed below:

    i.   Before using lavatory

    ii.   While using lavatory

    iii.   After using lavatory

    iv.   **Cleanliness monitoring system**

6.2.1   Before Using Lavatory

When the user comes inside the public toilet he/she will be instructed to insert the coin by using LCD display. As soon the coin is inserted the flush tank is automatically[10] flushed and then the door is opened.
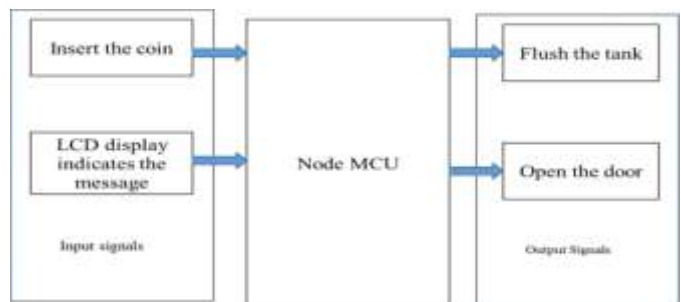

Figure 6.2.1 Block diagram before using lavatory

6.2.2 While using Lavatory

While the user uses the lavatory our system should keep monitoring the presence or absence of the user using PIR sensor[10] which prevents some other user outside the lavatory from opening the door and also gas sensor is implemented in order to continuously monitor the cleanliness level[5] in the lavatory and indicates whether the cleanliness level is high, medium and low.
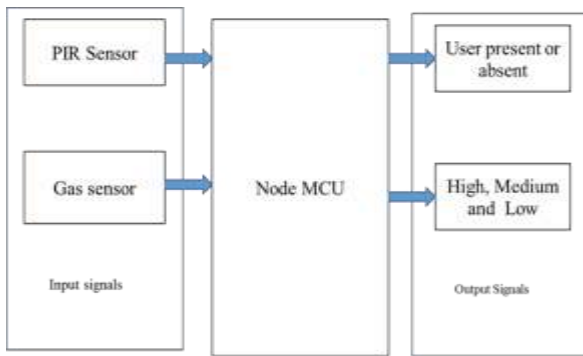
Figure 6.2.2 Block diagram while using lavatory

6.2.3 After Using Lavatory

When the absence of a signal is observed we get a low indication from the gas sensor then the[9] cleaning process begins. [1]Where at first pressurized water is sprayed, which is followed by spraying cleaning liquid and making it stagnate for around 1 or 2 minutes where it is further taken over by pressurized water and then[4] pressurized air is blown to dry the floor. The process ends up by spraying some room sprays and perfumes.[2]
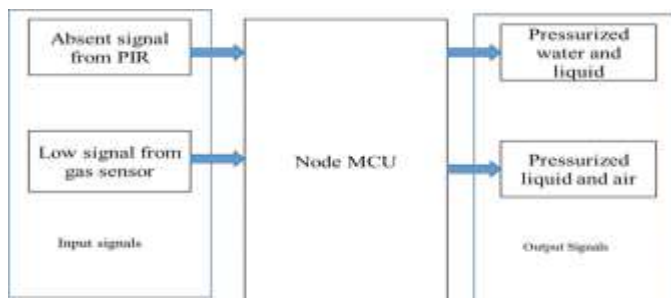
Figure 6.2.3 Block diagram after using lavatory

6.2.4 Cleanliness monitoring system

The overall cleanliness of the system is monitored and rated automatically , this rating is uploaded in cloud therefore whenever the user locates the toilet near to them in Google Map they can see the rating of the toilet. This is useful for the people travelling for long distances.
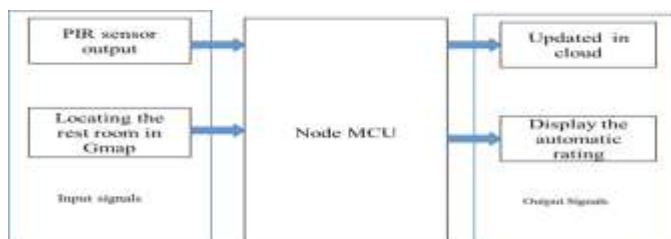
Figure 6.2.4 Block diagram of cleanliness monitoring system

6.3 OVERALL WORKING FLOWCHART:

Figure 6.3 Flow diagram of overall system

7. HARDWARE REQUIREMENTS

7.1 NodeMCU

NodeMCU is an open source IoT platform. It includes code that runs on the ESP8266 Wi-Fi SoC from Expressive Systems, and hardware that is predicated on the ESP-12module.

7.2 LCD Display

A liquid-crystal display (LCD) is a flat-panel electronically modulated device which uses the liquid crystals for light-modulating properties. Liquid crystals use a backlight or reflector to produce color images or monochrome, since it does not emit light directly. LCDs square measure obtainable to show whimsical or mounted pictures with low data content. A basic LCD liquid crystal show LCD digital display alphanumeric display} display consists of primarily 3 main parts: a layer of liquid resolution, polarizing panels, and a light source. Liquid crystals square measure rod-shaped polymers that bend in response to electrical currents. The liquid crystals act as various shutters, organized during a grid formation to let a selected quantity of white lightweight to pass. This grid formation is made with microscopic grooves on a supportive glass substrate. Set at right angles - horizontal and vertical - the polarizing panels are located on the rear and front of the liquid crystal shutters. Natural lightweight cannot enter through each polarizing panels once created during this manner, thus lightweight that travels through the rear

polarizing panel should follow the liquid crystal's direction to exit through the front polarizing panel. The liquid crystals allow or block this light in response to specific currents to create the image

7.3   Servomotor

A servomotor could also be a mechanism positioner or linear actuator that permits for controlling of angular or linear position, speed and acceleration. It consists of an appropriate motor coupled to a sensor for position feedback. It conjointly needs a relatively refined controller, often a fanatical module designed specifically to be used with servomotors.

7.4   Gearmotor

A DC motor is a electrical rotary machines which is helps in converting DC current into energy. Nearly all sorts of DC motors have some internal mechanism, either mechanical device or electronic, to sporadically modification the direction of current flow partially of the motor. A DC motor's speed are often controlled over a large vary, mistreatment either a variable offer voltage or by ever-changing the strength of current in its field windings. The universal motor will operate DC however may be a light-weight motor used for moveable power tools and appliances.

7.5   Gas Sensor

Gas sensor is a device that detects a gas leak or other emissions and may interface with an impact system so a process are often automatically packed up . It detects combustible, flammable and toxic gases, and oxygen depletion. This type of device is employed wide in business and might be found in locations, like on oil rigs, to observe manufacture processes

7.6 Ultrasonic Sensor

Ultrasonic sensor is device used to transmit ultrasonic waves at the frequency range of 40-70 kHz. It uses mechanism of echolocation as like in bats. It works by emitting ultrasonic sound waves and then waits for the sound to be reflected back, calculating distance based on the time required. This is similar to the working of radar which measures the time taken by the radio wave to return after hitting an object.

7.7 GSM Module

GSM is abbreviated as global system for mobile communication (GSM). It was developed at Bell Laboratories in 1970.GSM is a cellular technology that is open and digital. It transmits mobile voice and data services that operate at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

8. SOFTWARE REQUIREMENT

8.1 Arduino IDE

The Arduino Integrated Development Environment or Arduino code (IDE) - contains a text editor for writing code, a message space, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuine hardware to transfer programs and communicate with them.

9. RESULTS AND DISCUSSIONS

Overall front view of the implemented system is shown in Figure 9.1
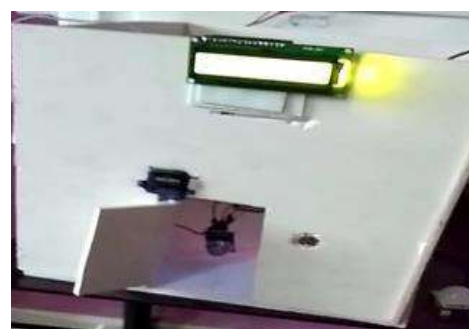

Figure 9.1 overview of the proposed model

The Greetings to the user is displayed in the LCD display which is shown in Figure 9.2

Figure 9.2 Welcome greetings to the user

The part the proposed model is implemented where the lavatory seat is flushed automatically and the door gets opened as soon the coin is inserted which is shown in Figure 9.3

Figure 9.3 Door getting opened automatically

The display which indicates the cleanliness level of the lavatory cubicle is shown in Figure 9.4

Figure 9.4 Cleanliness level being displayed

10. CONCLUSION AND FUTURE SCOPE

Thus the smart public lavatory has reduced the time of cleaning the toilet by using little amounts of water and also getting rid of infectious bacteria and viruses that cause diseases. The cleanliness achieved by an automatic cleaning system is good when compared to manual cleaning and also the human source is completely removed from the cleaning process. This work is further extended to include

- ❖ **Cloud:** Where all the data that are used to monitor the cleanliness is updated in the cloud and the automatic rating is done.

- ❖ **App development:** An application can be developed where the long travelers can locate smart toilets in Google maps and also view the rating of the toilet.

REFERENCES

[1] Arun Kumar C, Adithya Bharadwaj A, Balasubramanian R and Gowtham P. 'Autonomous Lavatory Cleaning System', International Journal of Robotics and Automation (IJRA), vol6, issue.4, pp.65-71, 2015.

[2] D. Kokvin, G.Sziebig and W.D. Solvang. "Design of a Robotic Arm for automatic cleaning of cargo containers" presented at the 4th International Conference on Cognitive Infocommunications (CogInfoCom), Budapest, Hungary 2013.

[3] D. Seo, H. Ko and Y. Noh. "Design and Implementation of Digital Door Lock by IoT", KIISE Transactions on Computing Practices (KTCP), vol.21, no.3, pp.215-222, 2015.

[4] E A Deulin, S S Mashurov and A A Gatsenko. "Sensor for the working surface cleanliness definition in vacuum", 23rd International Conference on Vacuum Technique and Technology, Journal of Physics: Conference Series, July 2016.

[5] Manya Jain, Pankaj Singh Rawat and Assist. Prof. Jyoti Morbale, 'Automatic Floor Cleaner', International Research Journal of Engineering and Technology (IRJET) vol. 4 issue 4, pp.303-307, April 2017.

[6] Priya Shukla and Mrs. Shimi S. L "Design of Inspection And Cleaning Robot', International Journal of Scientific Research Engineering & Technology (IJSRET)", vol3, issue6, pp.970-975, September 2014.

[7]Maneer Kaur and Preeti Abrol. "'Design and Development of Floor Cleaner Robot (Automatic and Manual)', International Journal of Computer Applications vol. 97, no.19, pp.0975 – 8887,July 2014.

[8]Kitisak Osathanunkul, Kittikorn Hantarkul, Part Pramokchon,Paween Khoenkaw and Nasi Tantitharanukul, "Design and Implementation of an Automatic Smart Urinal Flusher", in Proceedings of International Computer Science and Engineering Conference(ICSEC), December 2016.

[9] Uman Khalid , Muhammad Faizan Baloch , Haseeb Haider , Muhammad Usman Sardar , Muhammad Faisal Khan, Abdul Basit Zia1 and Tahseen Amin Khan Qasuria Faculty of Electronic Engineering, Ghulam Ishaq Khan, "Smart Floor Cleaning Robot (CLEAR)", Institute of Engineering Sciences and Technology, Pakistan Hamdard Institute of Engineering & Technology, Hamdard University, Karachi, Pakistan 2015.

[10] M.Premkumar, M.P.Chitra, X.Alisha Celestin, T.Kausalya, M.N.Nandhini Priya, " Game theory based Ad-hoc On Demand Distance Vector Routing Protocol to Extend the Wireless Sensor Networks Life Time Vol. 7, No. 3, , pp. 463~471, Sep 2019.