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IMPLEMENTATION OF SMART TOILET (SWACHH SHITHOUSE) USING IOT EMBEDDED SENSOR DEVICES

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Abstract— In the modern world, the technologies are drastically developed, but still the hygiene in our country is under threat. The abstract of this project is to provide clean and hygiene toilets. All the public toilets should be clean and hygiene. In our country, our government has introduced the scheme called "Swachh Bharat" (Clean India). Keeping the toilets clean is the one of the objective of Clean India scheme. My project can be helpful to promote the clean India project. In future, it can play the major role in clean India scheme. In an Existing system, they are concentrated only on detecting the dirt in the toilets. In our proposed system, I have concentrated on keeping clean toilets, monitoring the sweeper's working activities. It can avoid many diseases. It may create the awareness among people about the Toilet management. Therefore, our project is to use safe and hygienic toilets. The project based on IoT and image-processing concepts using different sensors like smell sensor, IR sensor, sonic sensor, RFID reader. By using these sensors, we can create the smart toilets.

Keywords— Smell sensor, IR sensor, sonic sensor, RFID reader, IoT, Image Processing

I. INTRODUCTION

In our country, people do not have enough knowledge of using toilets. This leads to several diseases, such as Malaria, Hepatitis, Flu, Cholera, Streptococcus, Typhoid, etc. Hence, I have introduce the project in the IOT called "**Swachh Shithouse**" The term Swachh means 'Clean'. Then the term Shithouse means 'Toilet'. It is introduce to use and maintain the toilets in the clean and hygienic way. The project is based on IOT concepts using different sensors like smell sensor, dirt sensor, sonic sensor, RFID reader, Database. Using these materials we are trying to provide the clean toilets and create the awareness among the people.

II. SCOPE OF THE PROJECT

In this project we are going to provide the clean toilet. This project can create the awareness among the people about the clean and hygienic toilets. This project can ensure the responsibilities of the sweeper. Finally, this project is the one of the stepping stone to the "Clean and disease free India".

III. LITERATURE REVIEW

[1] Kitisak Osathanunkul, Kittikorn Hantrakul, Part Pramokcho 2017 has proposed "Configurable Automatic Smart Urinal Flusher based on MQTT Protocol", This paper investigates one possible way to reduce the wastage of clean water used in a public toilet. The study focuses on saving clean water from the use of an automatic urinal flushing system in a toilet. The automatic urinal flushing is set with different water flushing duration parameter. This is to find the most satisfied parameter for users while spending clean water as less as possible. In order to adjust the parameter, an automatic smart urinal flusher system is developed. The system uses MQTT as an underlying communication protocol. The protocol is used in collecting, controlling, commanding and debugging the system. The results in the testing environment show that using a flushing duration for 2.5 seconds is enough to satisfy most users while wasting clean water as less as possible.

There are two part are involved here. They are,

1. Automatic Flusher Part (AFP)
2. Server part

The AFP detects if there is an object in front of its infrared sensor. When a user stands in front of the urinal, an infrared sensor can detect the user. If the user keeps staying in front of the sensor for 3 seconds continuously, it is considered that a user is currently using a urinal. After the urinal has been flushed AFP unit also sends a MQTT message about it usage data to the server part.

In server part, it receives the usage data from AFP unit. The usage data will be stored into a database for a future use.

[2] A. D. Kadge, A. K. Varute, P. G. Patil, P. R. Belukhi 2016 has proposed "Automatic Sewage Disposal System for Train", Indian railways have 114,500 km of total track over a route of 65000 km and 7500 stations. While travelling by the train everyone expect healthy and hygienic surrounding. Feel uncomfortable due to the waste on the platform and the allied foul smell. Creates bad impression on foreign tourist .sanitation problem cause due to system in which train toilets dispose human waste openly on to tracks. In this system, they are using two mechanisms. They are sewage disposal mechanisms and track changing mechanisms.
In the sewage disposal mechanisms, the ultrasonic sensor and position sensor is used. The ultrasonic sensor can detects the depth of the sewage tank and the position sensor detects the proper place to dispose the sewage. After the proper detection of particular place, the solenoid valve on. Then the sewage disposal is done.

[3] Pandya Chintan, Yadav Jatin, Kareliya Sanket 2015 has proposed "Automatic working bio-toilet tank for railway coaches", Bio toilet tank is human waste disposal mechanism in area with no infrastructure facilities. That is easy to operate alternative to the tradition waste disposal system. In that project are two doors in tank, the one input door and second exit door. The input door is on top of the tank and exit door is assembling inside the tank. The doors are open and close by using pneumatic cylinder. RPM controller is used to measure the speed of the train and transfer those details to proximity sensor, which can sends control over the train, Pneumatic cylinder is control by using RPM controller, Proximity sensor, and Compressed air tank. So, whole system is controlled with train speed. If the train speeds exceed 30 km/h then exit door will open and total waste depositor drop in tracks and input door is close. Input door is open when train is under 30 km/h speed.

[4] Iman Morsia, Mohamed Mansour, Mohamed Mostafa 2013 has proposed "Wireless Gas Detector System Using Microcontrollers, PLC and SCADA System for Monitoring Environmental Pollution", Gas identification represents a big challenge for improving detection and pattern recognition of each gas by using inexpensive gas sensor. Here they are presents gas detector system which is used to monitor, and measure gas pollutant emissions in the air and also used to detect different gases. The pollutants are ethane (C2H6) and methane (CH4) which are located beside the fertilizer factories in Alexandria Egypt and some other gases as hydrogen (H2), propane (C3H8) and iso-butane (C4H10).The gas sensors TGS-2611, TGS-816, TGS-2620 and TGS-823 from Figaro Engineering Inc. are used to build a gas detector system and it is located in the site of measurements. The data of each sensor is transmitted and received wirelessly using XBee module (DigiXBee 802.15.4) and microcontroller PIC 18F4620.
The system is controlled and monitored by using programmable logic controller PLC Step 7-200 from Siemens and Supervisory Control and Data Acquisition SCADA systems respectively. The principal component analysis PCA method is applied for clustering and distinguishing among different gases.
The results indicate that methane can be detected using TGS-2611 better than other sensors. Iso-butane can be detected by using TGS2620 and TGS-2611 better than others. Propane can be detected by using TGS-816 and TGS-823 better than others. Hydrogen can be detected using TGS-2620, TGS-816 and TGS-823 better than others.

[5] Thomas Schlebusch, Steffen Leonhardt 2011 has proposed "Intelligent Toilet System for Health Screening", Home monitoring is a promising technology to deal with the increasing amount of chronically ill patients while ensuring quality of medical care. Most systems available today depend on a high degree of interaction between the user and the device. Especially for people relying on advanced levels of care, this scheme is impracticable. In this paper they are presenting an "intelligent toilet" which is an extensive health check while being as simple to use as a toilet. Main focus of the system is to support the treatment of diabetes and chronic heart failure, but additional applications are possible.
Here the sensors like PT1000 sensor, Pressure sensor, RFID reader are used here. PT1000 sensor used to measure the thigh temperature. Pressure sensor is used measure the pressure of the base portion of the toilet. Using RFID reader is used to sense the particular person result. It needs designing of the base portion of the toilet. It can sense all test results of patients through the toilet usage.

IV. EXISTING SYSTEM

In the existing system, they concentrate more on disposing sewages from the railway system. They are trying to taking all the medical tests through the usage of toilets. They are concentrated on reducing water wastage on toilets, by the implementation of automatic flusher.

Disadvantages:

- They are not concentrated on providing clean and hygienic toilets.
- The medical test can have chance to produce fault results.

V. METHODOLOGY

- In the first phase of the project, IR sensor is used to detect the dirt present in the toilet.
- Here the set of sample images are given as input.
- After using the toilet, the sensor senses the basin of the toilet.
- Then it compares the sensed image with the input image.
- If the dirt present, it raises the alarm.
- Then the user needs to be clean the waste. Through this activity, people can get the awareness about the toilet management.
- In the second phase of the project, Figaro sensor is used to detect the unwanted gases present in the toilet.
- In the Figaro sensor, a particular range is to be fixed prior manner. If the range gets reached, it can send the alert message to the sweeper. Then they cleaned it by using proper fragrant.
- In the third phase, RFID reader (Radio Frequency Identification) is used to monitor the sweeper's activities (absence and presence in the toilet cleaning).
- Initially, the sweeper needs to show his/her identity tag in front of RFID reader. It can be shown before and after cleaning the toilet.
- Then the first phase gets activated and senses for the dirt presence in the toilet.
- If the dirt gets detected, it raises the alarm.
- Through this monitoring activity, the sweeper can realize their roles and responsibilities. Then they protect the people by disposing all the unwanted materials (dirt, unwanted gases) present in the toilet.
- In the final phase, the sonic sensor is used to detect the depth of the septic tank.
- Here, the range of septic tank is fixed prior manner.
- If the sewage reached reaches with the range, then it sends message to the organization.
- All the message transfer can be done by the GSM (Global System for Communication).

2.2 ARCHITECTURE OF THE PROPOSED SYSTEM

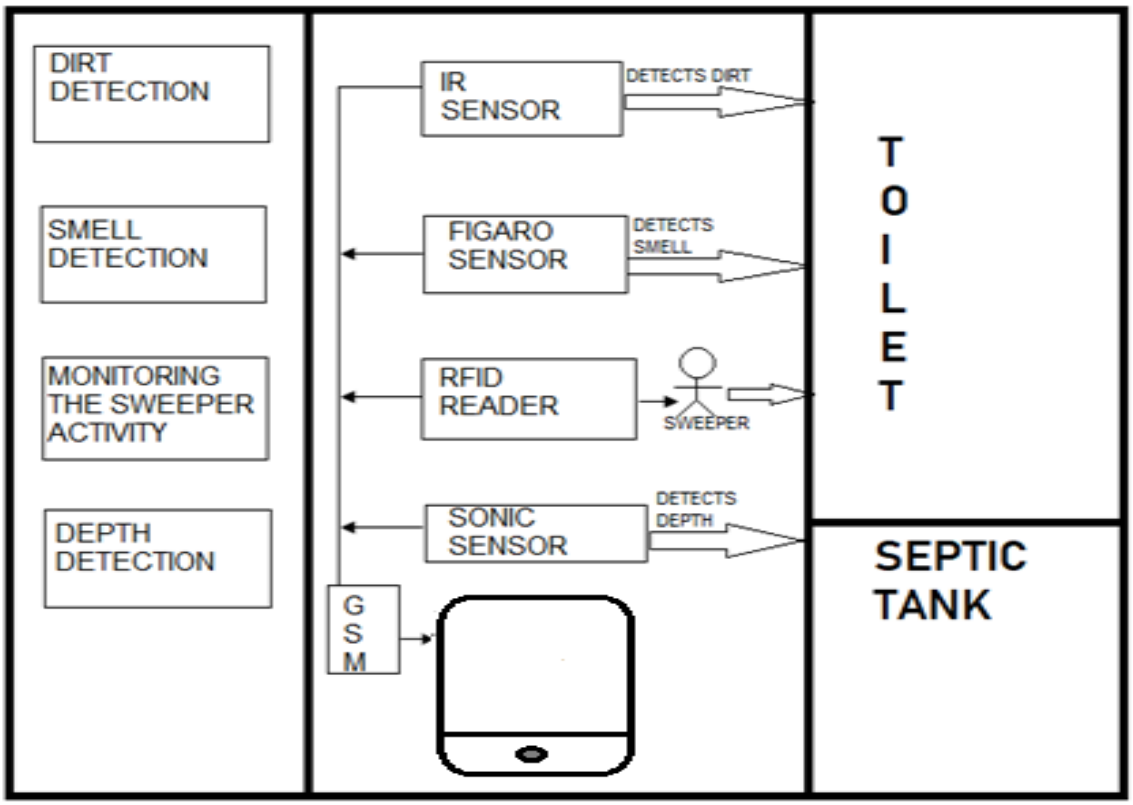

Figure 1.1: Architecture of the proposed system

2.3 DESCRIPTION OF THE ARCHITECTURE

HARDWARE REQUIREMENTS:

- Micro controller
- Power supply
- LCD display
- Buzzer
- Infrared sensor
- Sonic sensor
- Gas sensor
- RFID
- GSM modem

SOFTWARE REQUIREMENTS

- Embedded C

2.3.1 MICROCONTROLLER

A Pic microcontroller is used here. It is a integrated circuit. It can be consists of RAM, ROM, Program memory, etc. It is easy to use. Now it is widely used, because it is low price, high quality, easy availability. It is used for many applications like remote sensors, security and safety devices, home automation and in many industrial instruments.

Figure 2.3.1 Microcontroller

2.3.2 LCD

LCD stands for Liquid Crystal Display. All the outputs are displayed through the LCD display. LCD doesn't know about the content (data or commands) supplied to its data bus. It is the user who has to specify whether the content at its data pins are data or commands.

Figure 1.3: LCD Display

For this, if a command is inputted then a particular combination of 0s and 1s has to be applied to the Control lines so as to specify it is a Command on the other hand if a data is inputted at the data lines then an another combination of 0s and 1s has to be applied to the control lines to specify it is Data.

2.3.3 BUZZER

Buzzer is also called as Beeper. It is a sound signalling mechanical device.

Figure 1.4: Buzzer

2.3.4 INFRARED SENSOR

The IR sensor is used to detect the dirt present in the toilet. Here we feed the image samples into the sensor. It can detect the dirt by comparing the images we feed into it, after using the toilet. If it can detect the dirt, it raises the alarm, and the users may get embraced and they clean it. This system can create the awareness among the people.

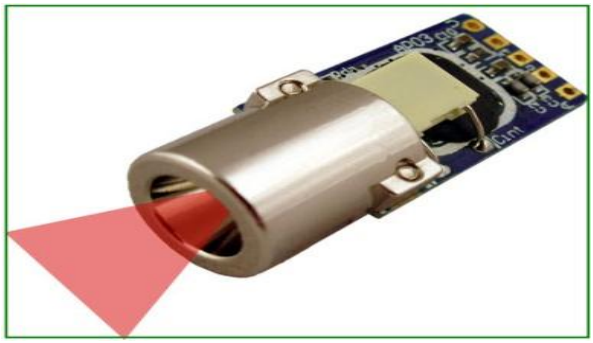

Figure 1.5: IR sensor

2.3.5 SMELL SENSOR

The Smell Sensor is used to detect the unwanted smell and gases in the toilet. For this purpose, we are going to use the sensor called **Figaro** sensor.

Figure 1.6: Smell Sensor

It can sense the dry gases present in the toilets such as NH_3, CO_2, CH_4, H_2S, etc. By taking those gases leads to Nausea, Drowsiness, immediate loss of Consciousness, etc. After sensing the unwanted gases, it can blink the red light. Then the sweeper can clean it by using particular Cleaning Agents.

2.3.6 RFID READER

The RFID stands for Radio Frequency Identification. It can be used for monitoring the Sweeper. The Organization wants to provide the identity tag for the Sweeper. The Sweeper needs to show the tag before the cleaning process is going to start and after it is finished.

Figure 1.7: RFID Reader

Then the CR4 sensor can detect the presence of dirt. If it is present, it can blink the red light. If it is clean, it can blink the blue light. It helps to understand the responsibilities of Sweeper by his/her own. If Sweeper is not clean the toilets for period of time, his/her absence in cleaning the toilet also reported to the consistent organization. These all the details are stored in the database.

2.3.7 SONIC SENSOR

The Sonic Sensor is used for measuring the depth. Here it is used to measure the depth of the septic tank. The Sonic Sensor is fixed into the Septic tank. Then the Septic tank get filled means, it can sends the messages to particular organization. Then they will allot persons to clean the septic tank. Then septic tank cleaners will clean the tank. After cleaning it, the sensor can detect the level, and send messages to consistent organization.

Figure 1.8: Sonic sensor

2.4 BLOCK DIAGRAM:

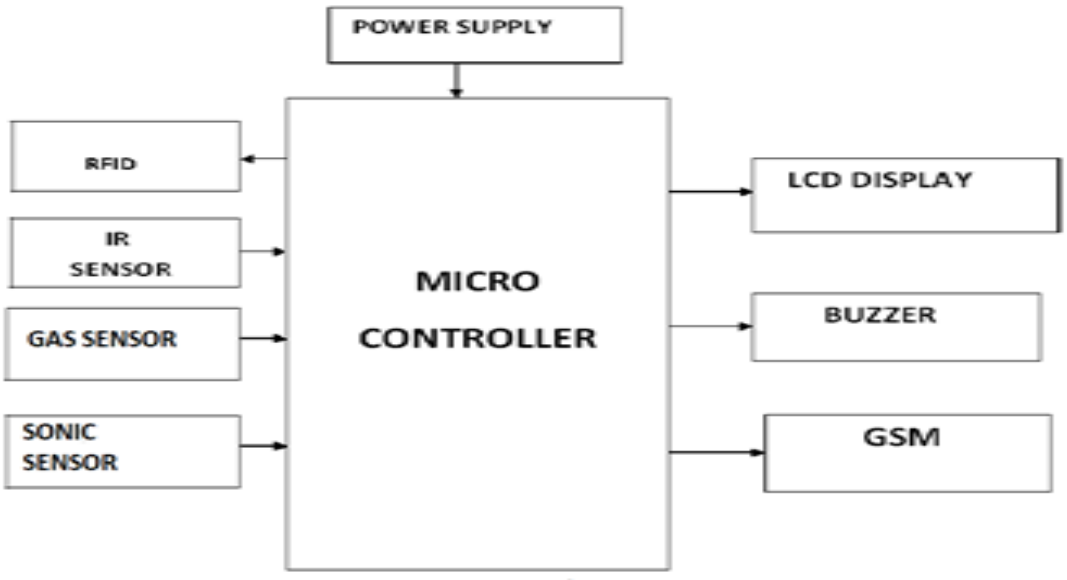

Figure 1.9: Block diagram of the proposed system

2.4.1 GSM

GSM stands for Global System for Mobile communication. It establishes the mobile communication from one place to another place.

Figure 1.10: GSM Module

It transfers the information from main circuit to operator. It uses Time Division Multiple Access (TDMA).

3.1 RESULTS AND DISCUSSION

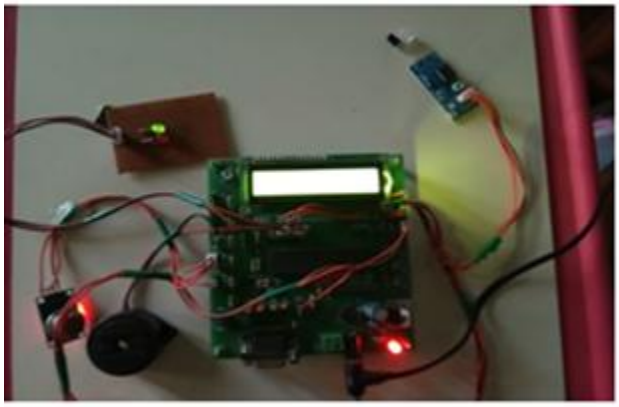

Figure 1.11: The proposed system

This is the module of the proposed system. Here the sensors are connected with the microcontroller.

3.2.1 SNAPSHOT 1

It shows the dirt detection in the toilets.

Figure 1.12: Output module, while detecting the dirt

3.2.2 SNAPSHOT 2

It shows the smell detection and depth detection.

Figure 1.13: Output module, while detecting the Gas and the distance.

3.2.3 SNAPSHOT 3

It shows the sweeper activities.

Figure 1.14: Indicates the sweeper presence

3.2.4 SNAPSHOT 4

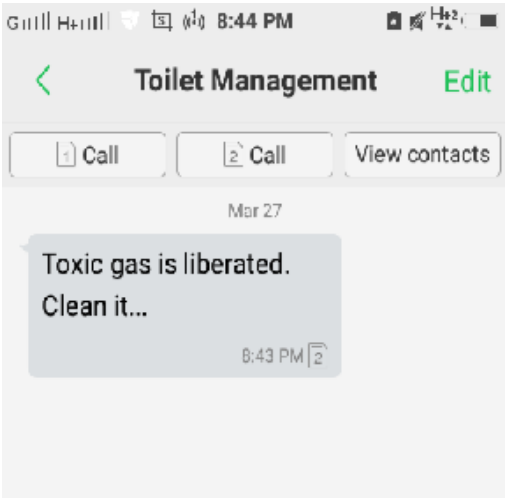

Figure 1.15 Message Transfer from Toilet management to Sweeper.

This is the module for transferring the message through GSM module.

3.2.5 SNAPSHOT 5:

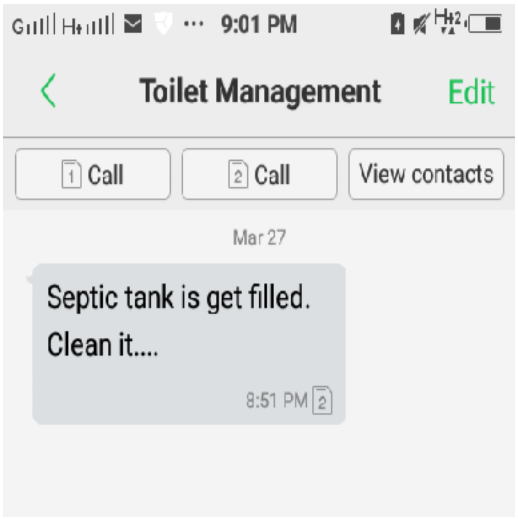

Figure 1.16 Message Transfer from Toilet management to Organisation.

ADVANTAGES

- It can creates an awareness among the people about the proper toilet management
- It can prevents the many contagious diseases like malaria, typhoid, cholera, streptococcus, asthma, etc..
- It can promotes the "Swachh bharat" scheme

4.1 CONCLUSION

Our proposed project will create awareness among the people about the proper sanitation. It makes use of Internet of things, which is a rapidly growing technology. Our proposed system will make everyone to strictly follow the cleanliness and proper sanitation in the toilets. It prevents the many new contagious diseases that spread due to improper sanitation of the toilets. Thus by using technologies in the smarter way, we can maintain the cleanliness which is next to the godliness. Keep Clean, Be Safe.

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