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IoT Based Wash room monitor and Alert system

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Abstract

This project describes advancement of toilets. Advancement of toilets is hygine for the socity. In this work, smart wash room monitoring system is designed and implemented using internet of things (IoT) with alert system.

Keywords: Smart wash room, IoT, Intelligent systems, Alert system.

1. Introduction

1.1 Preamble

The advancement in technologies related to all field is to a larger extent especially pertaining towards automation of every activity. At the same time, high security is also preferred. A public toilet (also called a bathroom, restroom, toilet room and so on) is a public toilet facility and at a minimum, a public toilet can be a single unit featuring a toilet and hand basin for hand washing. Public toilets can also be larger facilities, which may include bathing facilities or showers, changing rooms and baby facilities. Public toilets may be standing alone buildings or installation, or be contained within buildings such as railways station, schools, bars, restaurants, night clubs or filling stations. Public toilets can also be found on some public transport vehicles, for use by passenger. Public toilets are usually fixed facilities, but can also refer to smaller public portable toilets, or larger public portable toilets constructed as portable buildings. Public toilets are commonly separated by gender into male and female facilities. Although some toilet can be unisex, particularly the smaller or single occupancy types. Both male and female toilets may incorporate toilet cubicles, while many male toilets also feature urinal. Increasingly, public toilets incorporate accessible toilets and features to cater for

people with disabilities. Public toilets also divide in two types; which is squat toilets and flush toilets. Public toilets has generally contain with toilets (located within stalls with locking doors), urinals (man room ‟s only), hand wash faucets, soap dispensers, hand dryer, paper towel tissues, garbage dustbin and mirror. In Malaysia, Public toilet also similar with title of dirty, unhygienic, clean less and stinky. Many of public toilet are not unattended and users also take for granted with the cleanliness of toilet. Many people prefer to going for paid public toilet because it more attended and clean but now, there are many authorities person and residential of Malaysia, aware of the public toilets because the behavior of Malaysia are evident in the toilet if the toilet dirty, the Malaysian people also dirty. This awareness is important to make that others country believe that not most of the citizen are ignored the public toilets.

1.2 Internet of Things

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines are provided with identifiers (UIDs) and the ability to transfer data over a network without requiring human-to human or human-to-computer interaction. The definition of the Internet of things has evolved due to the convergence of multiple technologies, real time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers.

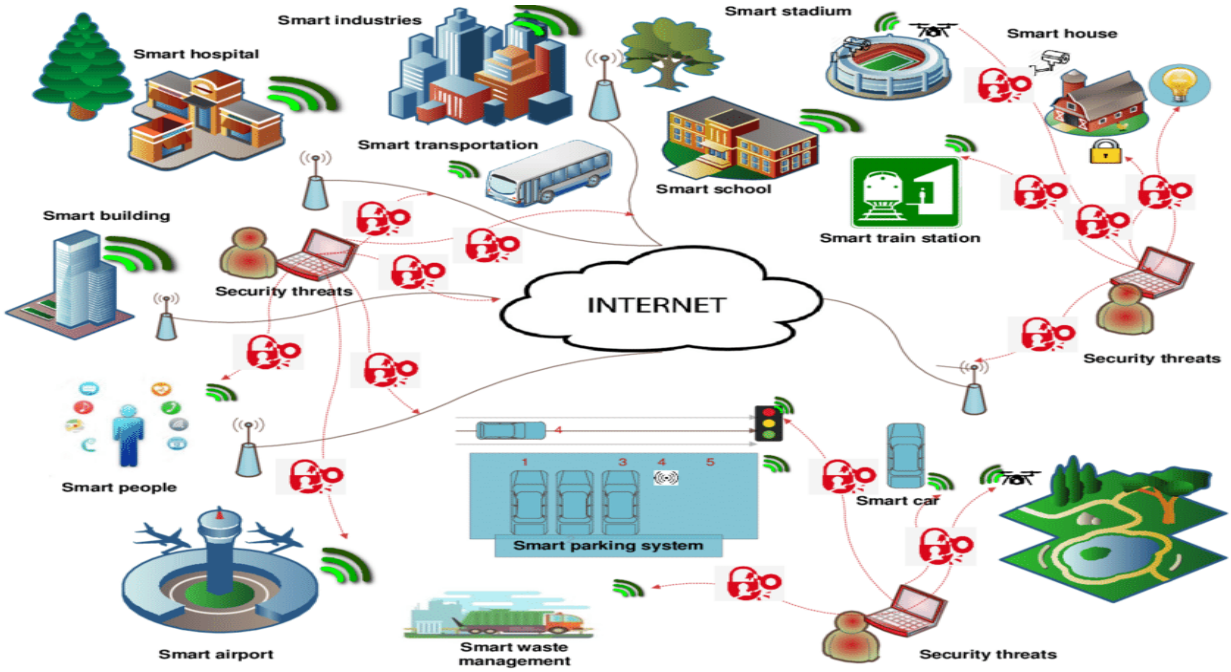

Figure 1. 1 Demonstrating the Various Things Connectivity to the Internet

1.3 Objectives

- To design a smart wash room which is equipped with sensor transceiver and wifi conductivity
- Remotely monitors cleanness status of restrooms.
- Cleaners can be dispatched when needed instead of fixed intervals.
- Allow building owners and Facility Management(FM) and cleaning companies to manage usage across multiple restrooms.
- Using data to plan resources ahead of time based on usage patterns.

2. Existing System

2.1 Literature Review

2.1.1 Smart Toilet Based On IoT

In today's world with the ever increasing growth in the population of India, the hygiene of our country is endangered. Our Prime Minister Sir Narendra Modi has introduced "Swach Bharat Abhiyan" Scheme to improve cleanliness in the country. Our project will definitely be a help to improve hygiene condition in India. It will create awareness among people in terms of "Toilet Management". The proposed system "Smart Toilet" is based on IoT, smell sensor, IR sensor, sonic sensor, RFID sensor. The smart toilet will take care of opening and closing of the toilet seat, the IR sensor tracks the dirt present on the toilet seat and raise an alarm, The

cleanliness of the toilet will be improved by monitoring the sweeper's activity to maintain the hygiene of the toilet, it also will deal with water conservation.

2.1.2 Smart Toilets using BLE Beacon Technology

With the advancement of micro electromechanical & wireless technologies for communication, Internet of Things sector has flourished at the worldwide platform and easy internet access has resulted in remarkable development in Information and Communication Technology. BLE beacons recently have become one of the IoT devices used for implementing Real Time Locating System. Since mobile internet may not always be available for indoor positioning thus we have developed our application of Smart Toilets a public toilet management and encouragement system based on the Bluetooth low energy beacons and readers technology to provide an effective system for management of public toilets by government thereby extending the applicability of BLE beacon.

2.1.3 Design and Development of the Red Cross Mobile Flush Toilet Toward the Smart Design Shelter

In emergencies, access to a proper toilet is a difficult challenge. The damage to basic infrastructure disturbs the operation of flushing toilets in shelters. Therefore, this study aims to develop a mobile flush toilet which is independent from the existing power supply, water supply and drainage. The field test was successfully conducted in the flood affected areas. The access to a proper toilet can be improved by prepositioning this mobile toilet, before disasters, at the public facilities which are used as shelters in emergencies. Furthermore, this toilet system can be used in developing countries where basic infrastructure is underdeveloped.

2.1.4 Smart Public Toilet Health Check System

Public toilets experience the perpetual problem of lack of hygiene. Appointing an all-time janitor is not possible at each and every toilet. Automation can reduce the janitor's burden by looking after the maintenance of the toilet and sending timely updates. We've tried to tackle this issue by developing an IoT-based smart system. We've used sensors to measure water level in tanks, water usage and to detect the presence of a person in the toilet. With the data from sensors, our system predicts the cleanliness of toilets. The sensors are interfaced with Raspberry Pi, which processes the sensor data and uploads it to the cloud. The necessary action is initiated by the Pi. The data collected by the sensors is fed to ThingSpeak, which

generates graphs. With its ready-made machine learning tools, ThingSpeak identifies patterns in data and provides an analysis, which can uncover some useful information.

2.1.5 Smart Public Toilets using IoE

"Health is Hygiene" is one of the most popular quotes and the most meaningful one as well. In the fast-moving world, the advances are growing at a high rate, at the same time the cleanliness in our society is at high risk. The main abstract of the paper is to improve the condition of public toilets and make them accessible to every citizen in a hygienic way. "SwachhBharath"(Clean India) project is one of the most trending schemes in our country. One of the objectives of the scheme is to provide uncontaminated toilets and to design and develop a user-friendly universal toilet which will be sustainable and should be successfully used by the people across all socioeconomic spectrum. This scheme is named as "Namma Toilet". The question now arises, If the toilets are maintained properly and are they clean to use? To monitor cleanliness, autonomously flush and to avoid the bad odor we have proposed this system. We have made use of the proximity sensor, biometric system, gas sensor and a dashboard to monitor and store the data of the cleaner's activity. With the help of these, we can bring in an effective way to maintain public toilets.

2.1.6 Development of the Smart Toilet Equipment with Measurements of Physiological Parameters

People's daily life is changing with the rapid development of industrial technology and enhancing quality of life. The products of healthcare industry are unconsciously integrated into our living environment. The growing interest in health monitoring during daily life has lead to many researchers on non-conscious biological signal measurements. In this paper, we propose the smart toilet equipment which can measure several physiological parameters including ECG, body weight and body fat ratio and also provide health management function. The electrodes mounted on the smart toilet seat are used for measuring ECG and bioelectrical impedance. The other is the hand-held electrode device for obtaining total boy bioelectrical impedance. The measured bioelectrical impedance and standard body fat ratio from 86 volunteers are obtained to establish estimate formula between of body fat and bioelectrical impedance and the square of correlation coefficient is 0.8682. We have developed an activity shaft device without the influence of the lateral force. The resulting average weight of the ratio of maximum and minimum in different load location was is 1.007. These physiological signals are transmitted to the remote server via blue-tooth wireless interface. Whether the

local side or the remote server end, the system also provides the friendly graphic user interface.

2.1.7 Design and Implementation of Urban Intelligent Public Toilets in the Big Data Era

Relying on the rapid development of big data, Internet of Things, cloud platform and other technologies, advanced Internet +, intelligent sensing technology and advanced network transmission architecture are used to design and implement a smart public toilet cloud platform. Aiming to serve the public's demand for urban public toilets, the system handles all kinds of tasks in a closed loop. And relying on the big data cloud platform of intelligent city, the system transfers data on the existing MANs, thereby accomplishing real-time intelligent control and realizing the intelligent management of urban public toilets.

3. **Hardware Description**

3.1 Introduction

In the Pandemic era, during the high transition of peoples from one to another place, the usage of public toilet (also called a bathroom, restroom, toilet room and so on) is getting increased. And also this public toilet can be a single unit featuring a toilet and hand basin for hand washing. Public toilets can also be larger facilities, which may include bathing facilities or showers, changing rooms and baby facilities. Public toilets may be standing alone buildings or installation, or be contained within buildings such as railways station, schools, bars, restaurants, night clubs or filling stations.

In view of that, this project composed of the necessary hardware components that are essential for building the system is discussed in detail. The crucial hardware includes a MQ137 sensor, PIR sensor, IR sensor, a Microcontroller to compute the ppm value and transfer the data, exhausted fan, room freshener, automatic lights ON/OFF. For this, a SMPS is also required to power the sensor and microcontroller with a regulated 5V DC supply.

3.2 FUNCTIONAL DIAGRAM

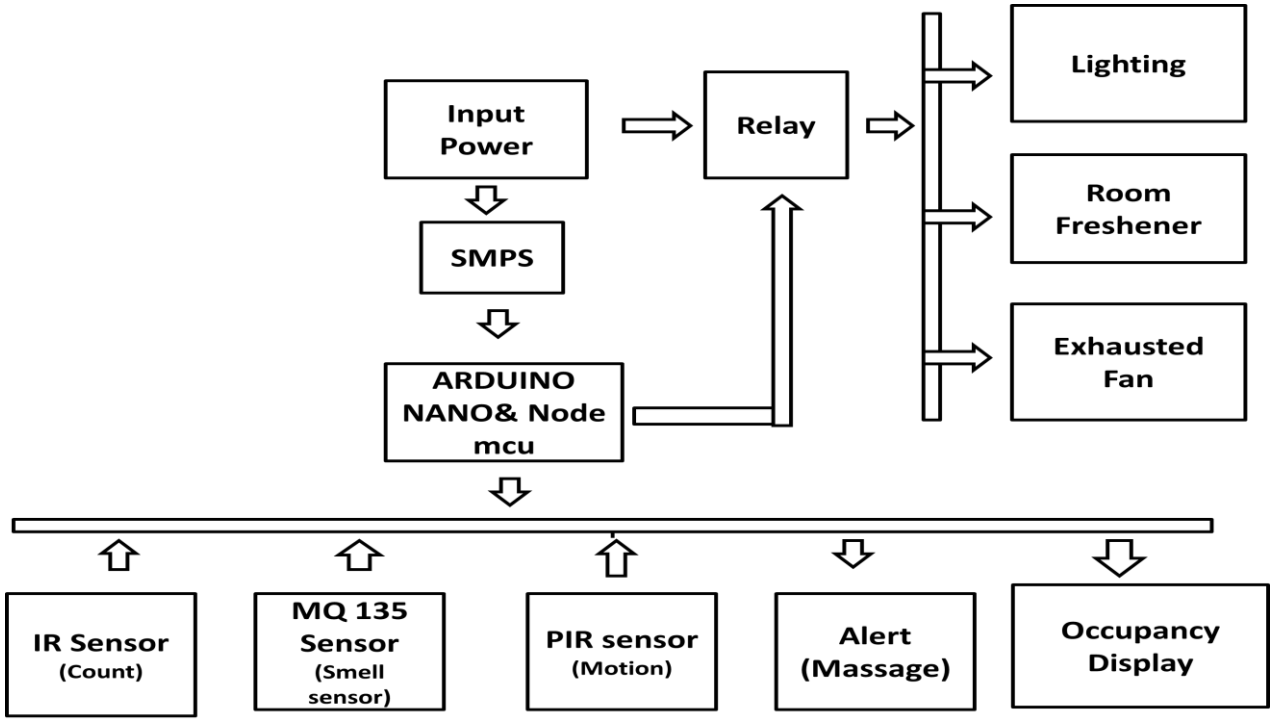

Figure 2 Functional Block diagram

3.3 ESP8266 - NODEMCU

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module Later,support for the ESP32 32-bit MCU was added.

4. Software Description

4.1 Introduction

The Arduino Integrated Development Environment (IDE) is a cross platform application (for Windows, mac OS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

4.2 Arduino IDE

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

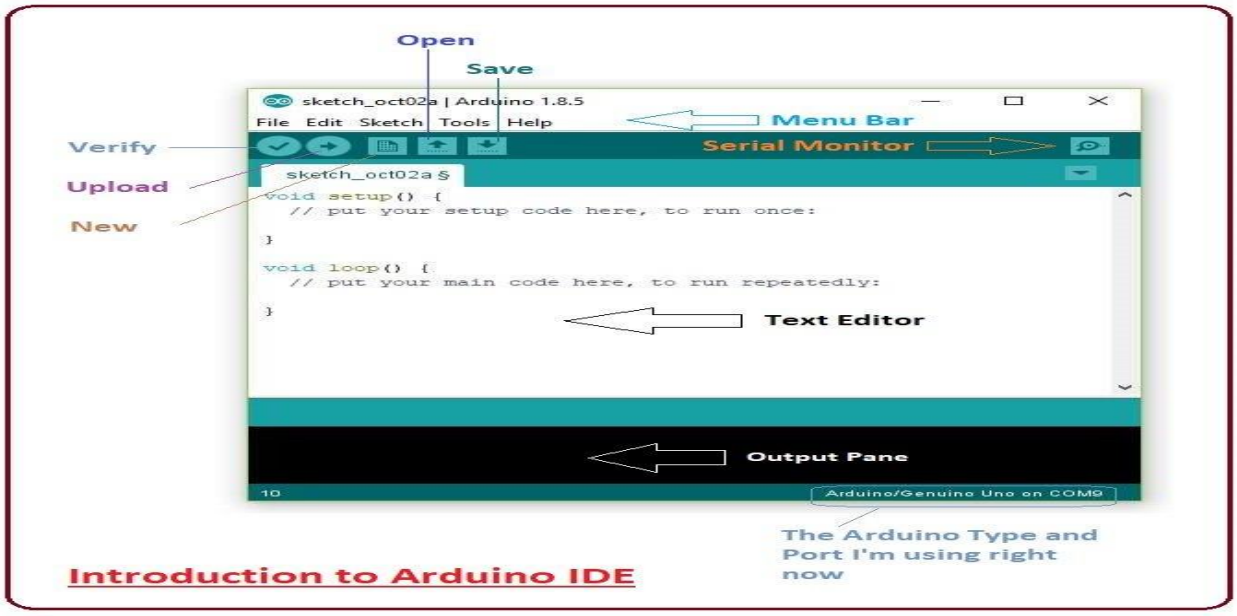

Figure 3 ARDUINO IDE

The IDE environment is mainly distributed into three sections

1. Menu Bar

2. Text Editor

3. Output Pane

4.2.1 Essential Libraries

Libraries are a collection of code that makes it easy for you to connect to a sensor, display, module, etc. For example, the built-in Liquid Crystal library makes it easy to talk to character LCD displays. There are 30 hundreds of additional libraries available on the Internet for download. The built-in libraries are available and some of these additional libraries that are need to downloaded from code repositories.

4.3 Blink APP

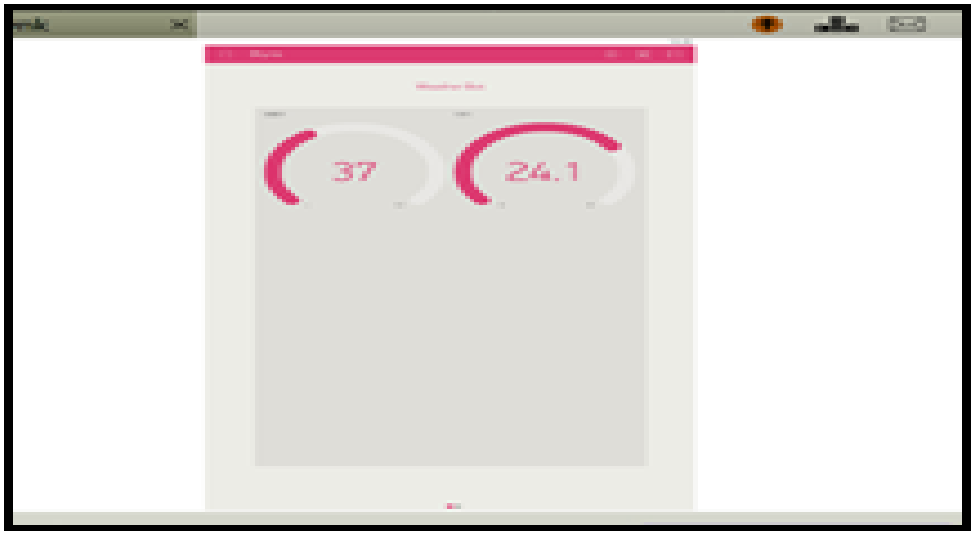

Figure 4 Blink Setup

Blink is a home automation company which produces battery-powered home security cameras. The company was founded in 2009 by Peter Besen, Don Shulsinger and Stephen Gordon. The company was initially started as Immedia Semiconductor Inc in 2009, but pivoted into a consumer electronics company. In 2014, the company had a Kickstarter campaign for their indoor security camera, which raised over US$1

million. Subsequently, Blink later announced an outdoor security camera, home security system, and video doorbell.

Amazon announced in December 2017 that they had acquired the company. In media Semiconductor, LLC continues to operate as an independent subsidiary. It is anticipated that Blink's technology will be used for the Amazon Key service. In December 2019, Amazon rolled out patches in response to research citing vulnerabilities in the Blink XT2 security camera systems found by vulnerability detection firm Tenable.

4.3.1 Set up my Blink system

1. Plug the Sync Module into any wall outlet.
2. Launch the **Blink app** for iOS or Android and run the Setup Wizard.
3. Place your **Blink** unit(s) wherever you'd like.

Once these steps are complete, **Blink's** wire-free design and included mount make it simple to shift or relocate your units.

5. Problem Formulation

5.1 Introduction

The biggest source of transport in India is Trains. Lakhs of people travel in trains daily and the most important facility in trains is “TOILETS” which unfortunately are not at all clean, safe and sanitized which leads to unhygienic surrounding. With so much being spent on the Swachh Bharat campaign it’s a pity that trains, which carry lakhs of passengers daily, do not have modern toilets. The current system of toilets in Indian railways is very unhygienic and foul to use and is downtrodden. There is no any cleaning system rather than by doing it manually, which requires lots of human efforts and still have more possibility of spreading the unhygienic and contagious diseases which are very dangerous and even life taking. Our Indian railways have the rail lines of 115000km approx. due to unaesthetic system of toilets leads to corrosion of rail lines. It is a need of time that we move forward and take the initiative of clean India. To reduce human efforts, a step towards “VISION 2020”. Logic comes from the lesser number of logic gates than the Full Adder (FA) structure. As a solution to all this problems we are developing our system which cleans the toilet automatically. Our system will work on basis of sensor like PIR Sensor, Gas sensors. Robotic arm which will clean the toilets and an android application which will give current status and all updates of working system to

the authorities/station master. The energy required for working of our system is generated using a solar panel.

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

5.2 Problem Statement

There is a need for a clean bathroom that needs to be accessible, easy to maintain, easy to use, sanitary, cheap, and provide good incentives. If need to clean a fixed interval, the more man power is required and also more hazardous in the washroom will leads to terrible diseases.

But the hard fact of today's society is that the conditions of the public toilets have not changed from years. Although many of us are aware of using toilets that saves water. Various syndromes can be detected in this non cleanliness of washroom. Based on this problem statement , this project is proposed here.

5.3 Proposed Methodology

The total ammonia level detects to MQ sensor continuously sensed through MQ 135 sensor and the recordings are pushed to the microcontroller. From the low level is detect the sensor automatically turn on and high level is detect the freshness spray automatically turn on and are calculated by the Node MCU.

5.3.1 Schematic of the System

The schematic of the system is shown below.+5V Power supply (common ground to microcontroller relay and sensor --not shown) is provided through a SMPS.

5.3.3 Experimental Setup/Hardware Prototype

The below figure depicts the hardware prototype that has been developed to realize the proposed methodology. The tests were conducted using the below experimental setup.

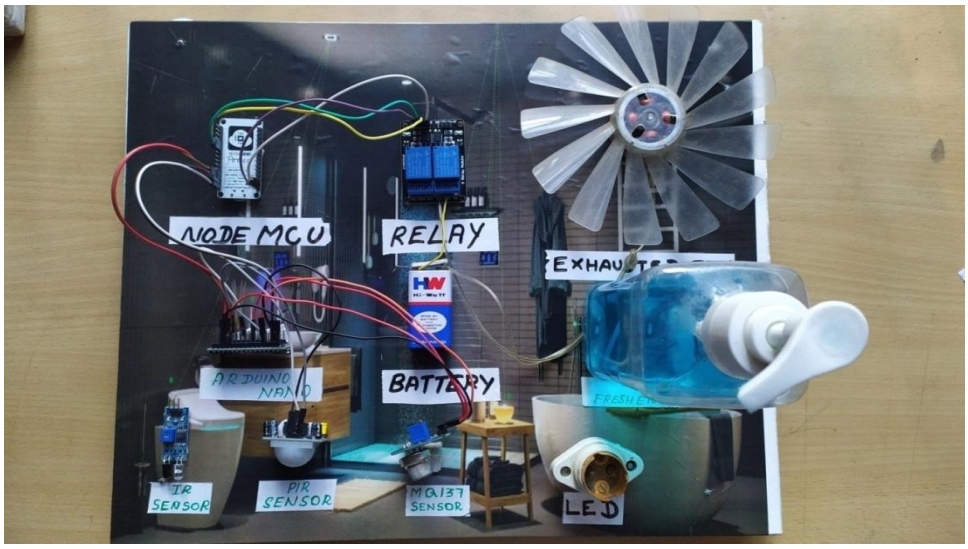

Figure 5. Experimental Setup/Hardware Prototype

6. Output of the Hardware

6.1 Output of the Different Places of Wash Room

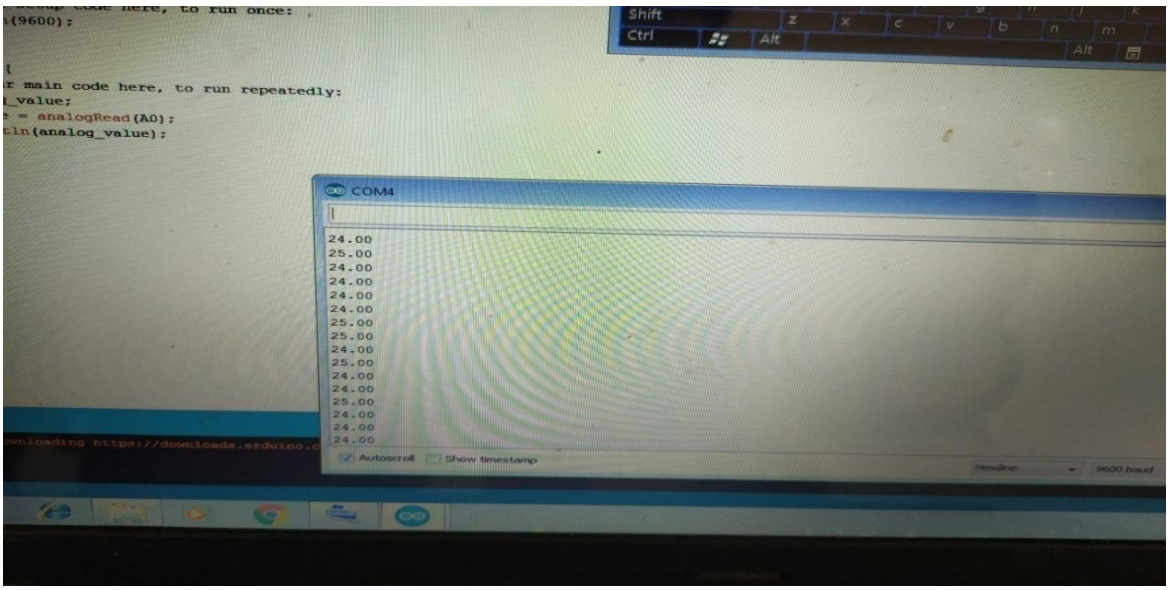

Figure 6. Output of Ammonia level in EEE block

By using the hardware setup in the washroom system, the ammonia level in the is measured in the outside of the room and calculated the range is from minimum of 24.00 ppm to 25.00 ppm

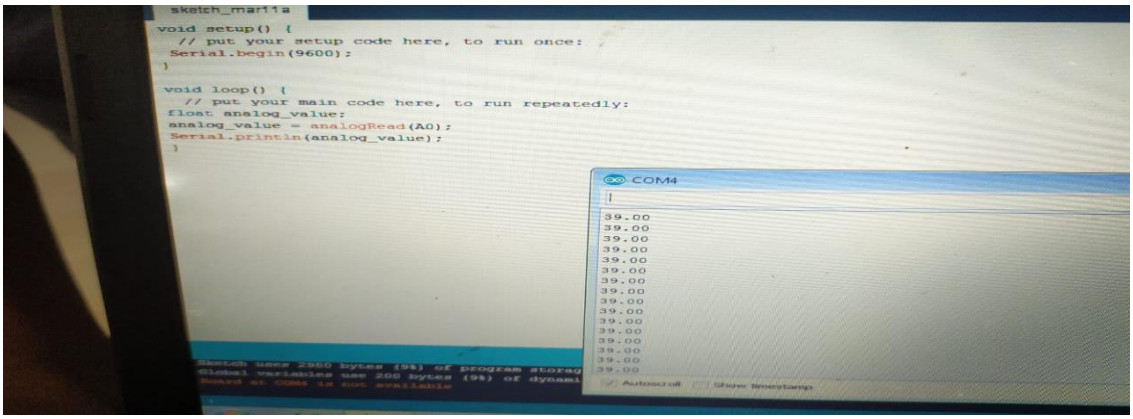

Figure 7.Output of Ammonia level in 'A' block

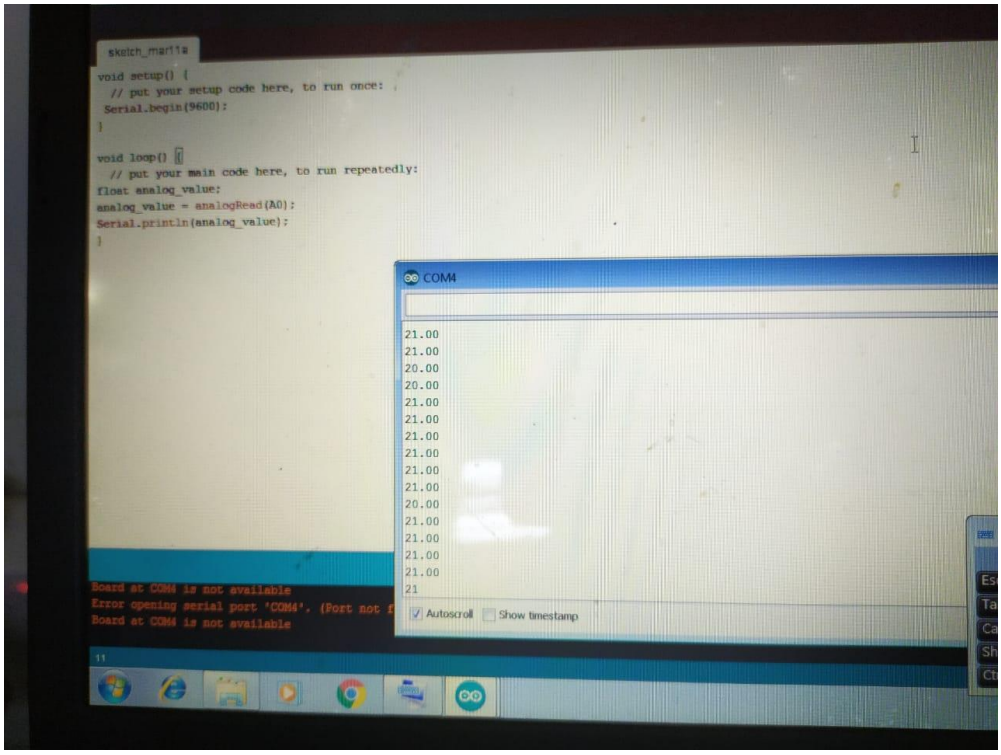

Figure 8. Output of Ammonia level in First Year block (outside the washroom)

By using the hardware setup in the washroom system, the ammonia level is measured in the inside of the room and calculated the ranges from minimum of 20.00 ppm to 21.00 ppm

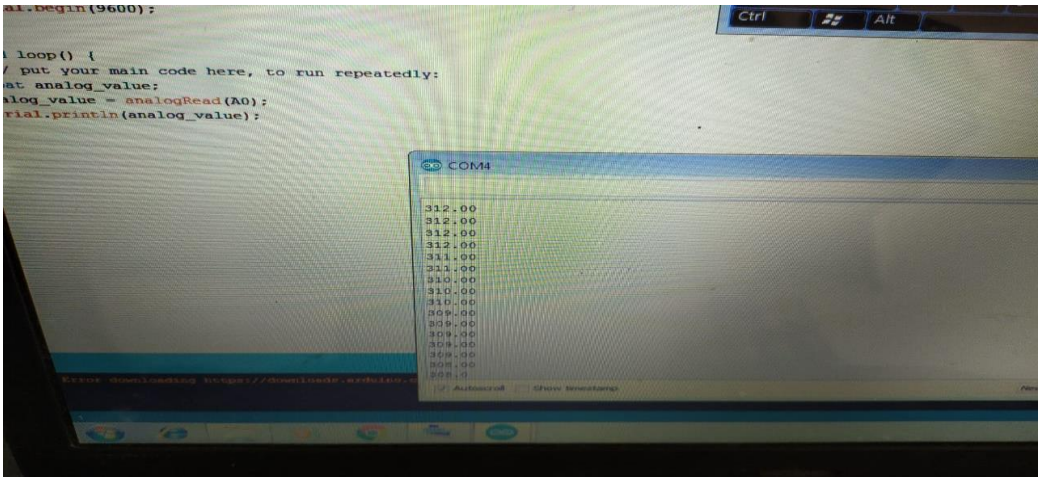

Figure 9. Output of Ammonia level

6.2 Working

MQ-137 GAS SENSOR attached to Arduino nano detects the ammonia level present in the air and displays the ammonia level in ppm on the LED display. If ammonia level is more than ppm then is switched on indicating to start the exhausted fan. If ammonia level is greater than ppm then is switched on giving an indication to clean the toilet because the smell is unbearable. Also if a person enters and leaves the toilet the usage count is detected by IR sensor and is incremented by one. If PIR sensor allow you to sense motion, almost used to detect whether human has enter in wash room LED light is turn ON human is leave the wash room LED is turned OFF.

7. Conclusion

Thus this proposed solution will aware a method of using washroom that is smart, hygienic and healthy. Our project will develop a sense of responsibility among people about how to use washrooms in a way that mandates the user to follow rules of cleanliness which will encourage the use of public toilets. Thereby improving sanitation in India. This will lead to Clean India or Swatch Bharath & Healthy India. Thus the advancement in technologies related to all field is bring for a large extent especially pertaining towards automation of every activity. At the same time, reduced the man power in cleaning the washroom by the fixed time interval.

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