



## DEPT. OF COMPUTER ENGINEERING

# SMART TOILET SYSTEMS

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# OBJECTIVE

- ❑ To design a smart toilet which is equipped with sensor transceiver and ethernet connectivity.
- ❑ Remotely monitors cleanliness 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.

# COMPONENT LIST

1. MQ-135 AIR QUALITY SENSOR(detects  $\text{NH}_3$  in air)
2. ARDUINO UNO
3. IR SENSOR
4. 16\*2 CHARACTER LED DISPLAY
5. BREADBOARD



# MODEL WORKING

1. MQ-135 GAS SENSOR attached to Arduino detects the ammonia level present in the air and displays the ammonia level in ppm on the LED display.
2. IF ammonia level is more than 1.5 ppm then green led is switched on indicating to start the fan
3. IF ammonia level is greater than 2.5 ppm then red led is switched on giving an indication to clean the toilet because the smell is unbearable.
4. Also,if a person enters and leaves the toilet the usage count is detected by IR sensor and is incremented by one.

# CODE

```
/*
 * Program to measure gas in ppm using MQ sensor
 * Dated: 03-03-2019
 */

#include<LiquidCrystal.h>

#define RL 20 //The value of resistor RL is 47K
#define m -0.263 //Enter calculated Slope
#define b 0.42 //Enter calculated intercept
#define Ro 76.63 //Enter found Ro value
#define MQ_sensor A0 //Sensor is connected to A4


int avg_value,n=0;
int fan=7,clean=8,ir=10;
int count=0;


int cnt=20;
LiquidCrystal lcd(12,11,5,4,3,2);


void setup()
```

```
{  
  pinMode(fan, OUTPUT);  
  pinMode(clean, OUTPUT);  
  pinMode(ir, INPUT);  
  
  Serial.begin(9600); // sets the serial port to 9600  
  Serial.println("NH3 in PPM"); //Display a intro message  
  //delay(2000); //Wait for display to show info  
  analogWrite(6, cnt);  
  lcd.begin(16, 2);  
}  
void loop()  
{  
  // count person with ir sensor  
  if(!(digitalRead(ir)))  
  {  
    count++;  
    Serial.print("Count=");  
    Serial.println(count);  
    Serial.print("Total=");  
    Serial.println(count/2);  
    digitalWrite(LED_BUILTIN, HIGH);  
    delay(1000);  
  }  
}
```

```
//ppm levels check with MQ-135 and controlling fan, clean msg
float VRL; //Voltage drop across the MQ sensor
float Rs; //Sensor resistance at gas concentration
float ratio; //Define variable for ratio
VRL = analogRead(MQ_sensor)*(5.0/1023.0); //Measure the voltage drop and convert to 0-5V
Rs = ((5.0*RL)/VRL)-RL; //Use formula to get Rs value
ratio = Rs/Ro; // find ratio Rs/Ro
float ppm = pow(10, ((log10(ratio)-b)/m)); //use formula to calculate ppm
Serial.print("NH3 (ppm) = ");
Serial.println(ppm);
//Serial.print("Voltage = "); //Display a intro message
//Serial.println(VRL);
if(ppm>2.0 && n!=2)
{
    n=2;
    digitalWrite(fan, HIGH);
    digitalWrite(clean, HIGH);
}
else if(ppm>1.2)
{
    n=1;
    digitalWrite(fan, HIGH);
    digitalWrite(clean, LOW);
}
else
```

```
{  
    n=0;  
    digitalWrite(fan, LOW);  
    digitalWrite(clean, LOW);  
}
```

```
//lcd printing  
lcd.setCursor(0,0);  
lcd.print(String("Count=")+String(count/2));  
//lcd.print(count/2);  
lcd.setCursor(0,1);  
lcd.print(String("NH3 ppm=")+String(ppm));  
//lcd.print(ppm);  
}
```



# DEVICE OUTPUT

- ❑ Device performs various tasks based on the ammonia level present in the restroom as follows

DETECTED AMMONIA LEVEL IN PPM	TASK PERFORMED
0 - 1.5	No Significant Smell(No task performed)
1.5 - 2.5	Bearable Smell (Put fan on)
2.5 and above	Unbearable smell (Clean toilet urgently)

- ❑ IR sensor increments the person count by one when a person enters and leaves the restroom. Thus, track of toilet usage is monitored .

For more details visit

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[bit.ly/smart-toilet-system](https://bit.ly/smart-toilet-system)

Thank You!