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# SMART DRINAGE MONITORING AND CONTROL SYSTEM

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*Abstract:* Though our nation has advanced in various sectors like industries, defenses, IT etc. we still have conventional way of problem solving or occupations still prevalent. Drainage cleaning is one of them. The drainages are, in major places cleaned by human beings. In this project we aim to minimize the manual labour in drainages, by implementing some electronic components. Various components like flowmeter, temperature sensor, level sensors are placed on the surface to detect various level of parameters. 'Smart drainage monitoring and control system' uses an ARDUINO microcontroller to receive inputs from drainage through various sensors to produce appropriate output and monitoring. This project is to help whoever goes into the pipe feel a bit safer and have little less hazards to deal with.

***Index Terms*** **- Arduino, Microcontroller, Sensor, Drainage**

## I. INTRODUCTION

II. Smart drainage monitoring and control system using Arduino is proposed to overcome real time problems. Nowadays the sewage problems from industries is increased. The proper disposal of the wastage and effective planning is the main goal of any industry [1]. This proposed system controls the level of drainage using ARDUINO and other sensors like level sensor, temperature sensor, flowmeter and gas sensors. A buzzer is used for notifying the officials and taking necessary actions. ARDUINO empowers users to help communicate between the electronic components and the user commands. Through wires these components are connected to Aurdino microcontroller. The programmable part that dictates the performance is called Integrated Development Environment-IDE.

There are some situations of direct human interaction in the cleaning. The difficulties in the work environment has been reduced by this system. From a remote location the supervisor can access the system using a password protected computer. In recent years the flooding problem also causes the drainage systems to overflow. When there is a blockage of drainage system water overflow occurs. This water consists of waste material that are non-biodegradable causes climate change and flooding [2]. The gases produced due to waste in drainage are harmful which cause serious problem if humans inhaled this in large amount [3]. If there is a block it is not easy to find exact location. We cannot receive early alerts of blockage [4]. Manual monitoring is inadequate. It needs many persons who completely report with less precision.[5]

## II .MATERIALS USED

1. ARDUINO:
   It is a single integrated chip which can accomplish the logical functions. These functions can perform using processor core, memory, and programmable input/ output peripherals.

2. GAS SENSOR :
   Here a MQ2 sensor is used for detecting the smoke and various gases inside the pipe. MQ2 is able to detect $H_2$, LPG, $CH_4$, CO, Alcohol, Smoke or Propane. The sensor contains a resistive coil inside the net surface and the gases exposed changes the resistance, thus sensing the gas. Its sensitivity can be changed by turning the potentiometer.

3. NODEMCU ESP 8266 :
   To transmit the data from the Arduino ESP8266 is a Wi-Fi module is used. It is a chipset which is used widely for IoT uses. A firmware that runs on the chip based on the ESP -12 module is included.

4. WATER LEVEL SENSOR:
   Water level indicator passes information to a control panel which indicates the level of water. The overflow of water can cause troubles. This water level indicator aids in detecting the level of drainage. The sensor has vented strain gauge on its surface. The difference in the pressure is measured by the gauge and the suitable sensing is performed.
5. SOLENOID VALVE
   The solenoid valve is an equipment used by the principle of Electromagnetism. The main function of this is to control the fluid flow. It can regulate the direction, velocity and the rate of flow of the medium.

6. TEMPERATURE SENSOR:
   A temperature sensor can measure the temperature and transduce the temperature to electrical signal. For demonstration purposes, LM35 sensor is employed. Based on the temperature around it the output voltage varies. The main merit is no external calibration is required.

7. FLOW METER :
   To check the velocity of the water flow ,the flow meter is used It is also employed to find the blockage in the pipe using the velocity of the flow. It contains a turbine which rotates based the velocity of the water. This is converted to electrical signal.

8. EXHAUSTER :
   An exhauster is placed to vent out the gases inside the pipe. This also helps in reducing the temperature inside it. The exhauster is worked with the help of a solenoidal valve.

9. THINKSPEAK :
   Think Speak is a free cloud software. The data from the sensors are uploaded to the cloud using the NodeMCU module. Using a cloud, the specific cloud can be accessed. The data are uploaded and displayed graphically.

## III. METHODOLOGY

Wireless Sensor Network is a monitoring generation that consists of sensors which reach and combine the use of a Wi- Fi community machine. Every node consists the statistics processing (microcontroller, e.g.: ARDUINO), memory, NRF transmitter/Receiver, power deliver machine and employed a number of sensors. To overcome the existing technologies disadvantages we develop a 24 hour monitoring system for drainage. Use of water level sensor we can sense the water level in the drainage and if come at a dangerous level the system will automatically indicates the maintain centre. And also we create additional water pumping system it uses the filtered drainage water for pumping, it will automatically on and pump the water forcefully to the blocked area. They so if it works, the block will automatically remove, and the water level is automatically fallen, (if the water level rise is based on block by any waste substance).ARDUINO is the main unit in this system. To monitor and take inputs from various sensors the Arduino processor is programmed. From these values, based on preloaded program specifying the benchmark, the chipset will take the decision and act accordingly. The Arduino communicates with the Node MCU and transmits the data to the Think Speak cloud. It is updated in regular intervals and the changes c an be seen as a graph with parameter on Y-axis and time on The X-axis

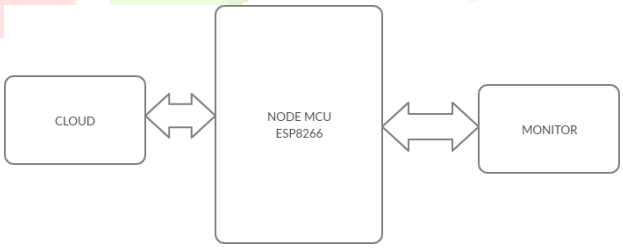


Figure 1. Maintenance side Block diagram

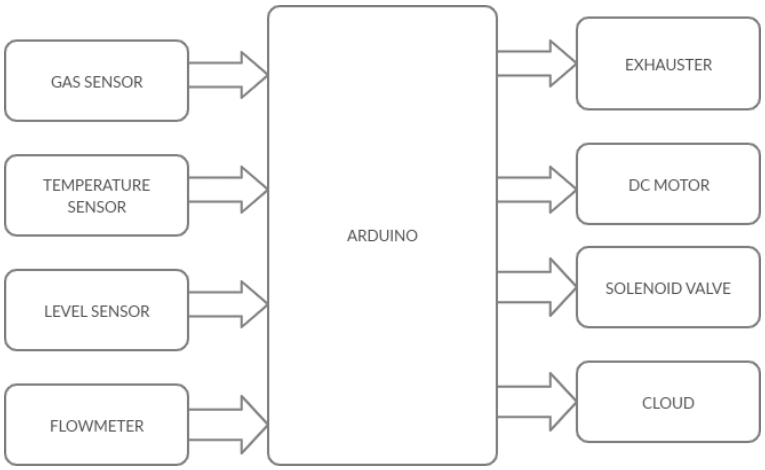


Figure 2. Drainage side Block diagram

The system is assembled as such and the various parts are functioned and monitored individually. Similar conditions are created for the sensors to perform. The Arduino microcontroller is connected to the sensors and the data from the transducers are accepted. The program is written with the actions expected from the system. It is loaded to Arduino using an OTG cable. The Wi-Fi module is programmed appropriately to perform. The flow and the level of the water inside the drainage increases when the drain is blocked from the waste materials. Level sensor can provide an idea for the user about the space left inside the pipe and help in planning future needs. If the velocity of the water is too low, a buzzer is activated along with an LED. The rise in temperature is expected in a confined pipe containing toxic gases with very limited illumination. So it is necessary to keep track on that parameter. If somebody have to be inside the drainage for cleaning purposes, the long exposure to various dangerous gases inside thecan make him/her a lifelong patient.

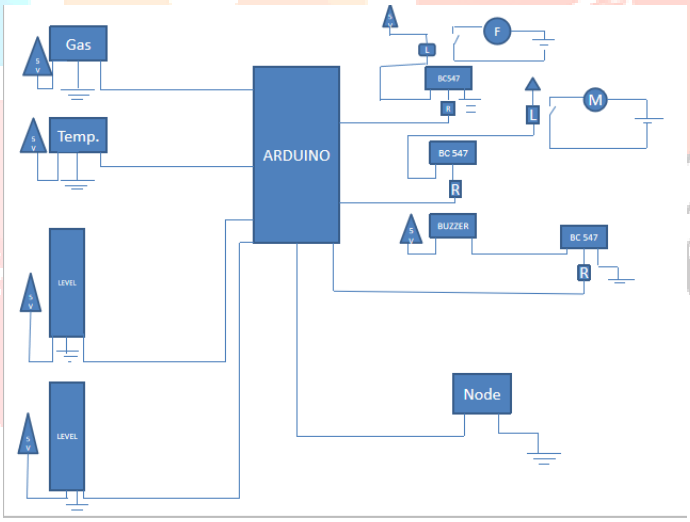


Figure 3. Schematic Diagram

The gas sensor is placed for detecting the toxic gases inside and if it exceeds a safe limit, it is informed and at the same time the exhauster is excited helping in reducing the temperature and the gas content. The gas sensors detect the decay gases and toxic gases filling inside drainage system. They give alert signals as LED indications and buzzer indications. As the water level sensors detect its maximum limit, a water cleaning pump is activated. All the actions are taken place through a wireless communication which is done by NodeMCU WiFi microcontroller. For proper power distribution a number of electronic components are added. The main advantages are design is simple. Cost is less. If required data can be available to public. Some of demerits are not very much reliable .Updation of clouds take more time. Non real time updation find some times difficult.

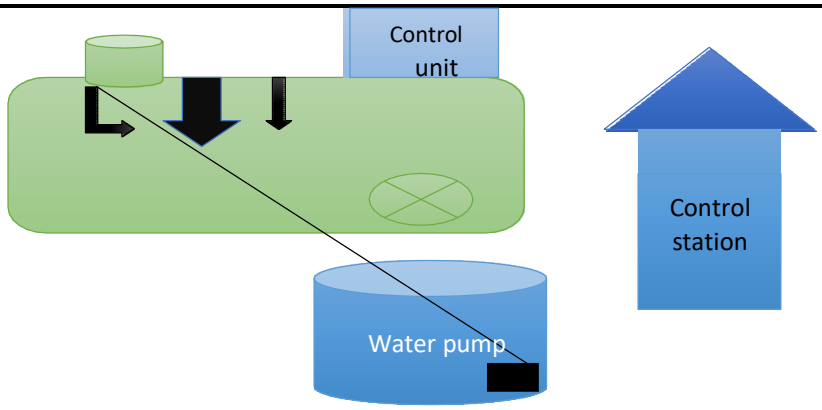


Figure 4. Circuit Diagram

## IV. WORKING

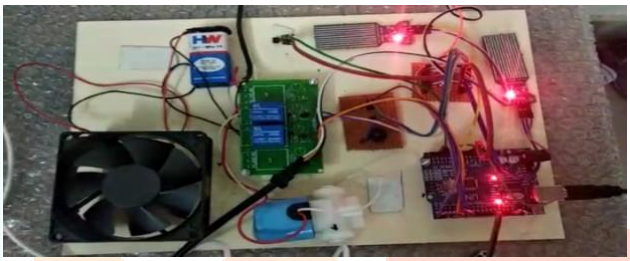

Figure 5. Implemented project

This project is mainly employs with an Arduino chip. It is a microcontroller based device. Here it senses mainly 5 values. These values are from the flowmeter, temperature sensor(LM35), gas sensor(MQ2)and 2 level sensors. Here the Arduino accepts the data from these sensors and send it to a cloud called thing speak with the help of a node MCU module (ESP8266 Wi-Fi-module). It helps to the inter communication of the thingspeak cloud with the API key provided by the channel in the thing speak cloud. There are some programming codes given to the Arduino for the proper working.

1. Water Level: There are 2 level sensors placed at top and bottom of the pipe. When the water level is between the individual limits of water level sensors, the system is in normal condition. If the water level goes below the limit set in lower level sensor or higher the limit of top level sensor, the buzzer is powered

2. Temperature:
   Here, we introduce a source of heat to the sensor. When the temperature increases, the LM35 sensor senses the values and the Arduino port reports the said values. When it exceeds the limit, it is made notified and the exhauster starts to work.
3. Velocity of flow:
   The employed flowmeter has a turbine based sensor. The speed of the turbine determines the outputted electrical signal. When the flowrate is reduced below a certain set limit, the buzzer is activated to notify the people of concern.
4. Gas and smoke:
   MQ2 gas sensor is placed in front of the smoke or the gas. The resistance of the coil inside the sensor changes upon the contact with this smoke. This change is the output of the MQ2. As usual, if the value increases beyond the determined limit the buzzer is activated and the exhauster is worked.

## V. RESULTS


Figure 5. Output Results

In order to make system smart different types of sensors are used. The system developed to monitor the level of water, flow of water ,gases and level of temperature. If the gas exceeds the limit value MQ2 sensor detects it ,the buzzer works and the values are indicated on screen. Excess gases are removed automatically by operating the exhaust valve. If the temperature exceeds the limit value LM35 sensor detects it and operates the buzzer by alarming it.Then the indicated value is shown on the screen. Using exhaust valve excess temperature is removed. The level of drainage can be detected by the water level sensor and this level is shown on the screen. When there is blockage the overflow of water occurs. Through the cloud exhaust fan is employed.

## VI. CONCLUSION

IoT projects based on Arduino are of low cost and easily manageable. This project can be treated as a stepping stone towards a hardware project that can perform in critical states. The prototype working model performs comparing real time data and taking actions. The inputs to the Arduino chip from sensors dictate the actions of the system. The monitoring of these data helps the concerned to be aware about various changes in the parameters. For monitoring and troubleshooting purpose a smart drainage system was implemented.

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