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IoT Based Smart Sewage Monitoring System for Smart City

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Abstract: ***Sewer monitoring is an important aspect of maintaining cleanliness around us. Lack of sewage monitoring systems may lead to blockage of the drainage. These blockages in sewers may lead to sewer flooding and pollution. Sometimes, workers may meet with accidents as they might not be aware of the condition inside the manhole.***
This paper aims to measure and analyze the real time levels of sewage. In order to ensure safety of the workers working under some severe conditions. This project attempts to devise an IOT technology that shall detect the level of sewage in the tunnel while keeping track of flow rate of it. If the level exceeds beyond threshold, it shall send an alert through the blynk web app. Additionally provide the information about the flow through the blynk web app itself. To obtain the desired output ultrasonic sensor, flow sensor, nodemcu esp8266, Arduino Uno and blynk web app are used in the proposed model.
Keywords: Internet of Things, Smart City, IOT, Nodemcu Esp8266, Ultrasonic Sensor, Flow Sensor, Blynk

I. INTRODUCTION

Every city needs the Internet of Things. Population of India is increasing rapidly day by day. It will increase more in the future, with even denser populations. Smart solutions can be created using connected technologies and big data. These solutions can solve problems, improve the quality of life for city dwellers, and reduce resource consumption. The Internet of Things is a necessary component for a truly smart city to function at its maximum potential.

Monitoring the underground drainage system plays a very important role in keeping the city clean. The population is growing very fast and many problems are faced in Smart Cities. In India, the process to monitor and maintain the drainage system is done manually. Current improvements and sophistication in planning are essential in the modern environment. Wastewater consists of solid and liquid waste generated from hospitals, factories, factories, and households. Dangerous gasses are released from these wastes, affecting the health of people. When sewer workers are exposed to the toxic gas, they are more likely to be affected by illnesses such as paratyphoid fever, hepatitis and even death. Manual drainage pipe monitoring and cleaning is required, but too long cleaning can create an unhealthy environment and spread many illnesses.

Sewage management is a critical component of urban infrastructure, and it has a direct impact on our daily hygiene. Poor sewage management can result in urban flooding, which is especially common in densely populated areas. IoT Based Smart Sewage Monitoring System for Smart City can help solve this problem.

II. LITERATURE SURVEY

In IoT Based Underground Drainage Monitoring System Paper (2020), G Chandhini, B Chithra, P Kiruthikadevi, Bhagya Sasi and V. Kamal Kumar presented the project. The primary goal of this project is to create a network system that aids in the monitoring of dangerous gasses found in sewage. The information with different gas ppm levels is presented in the smartphone through the app if the gas level reaches the threshold value. It also reveals whether working in the environment is safe for manual scavengers.[1]

In a paper sewage level maintenance using IoT (2018), G. Gowthaman, K. Hari Haran, G. Keerthee Rajan and A. Sweeto Jeiso proposed a solution for the creation of an IoT-based sewage level maintenance system, with the sewage level being monitored using a magnetic float level sensor. A sensor that detects sewage level, a controller that orders, and a communication network that records complaints about continual sewage level rises and, if any, blockages are all part of the system design. A database must be kept in order to keep track of the information. Prior to overflow, the system provides warning signals in the form of complaints sent via mail and SMS to the appropriate departments.[2]

In a paper, Authors proposed a project that aims to create an IoT system that can detect humidity, temperature levels, and gas mixtures, sensing each type of gas to measure its level while keeping track of the above parameters' real-time dynamic changes. It will send a warning to the connected mobile devices of the approved people who are remotely located in the job if the levels rise above the threshold.[3]

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In another paper IoT Based Smart Sewage Monitoring System using GSM and Wi-Fi Module (2021), authored by Priya Tiwari, a system model with the goals to develop a low-cost, economical and adaptable solution for detecting clogs and stink or unpleasant odor gasses is proposed . To get the necessary output from the module, this model uses a regulator circuit, sensor driver circuit, microcontroller, serial communication devices, and IoT module.[4]

Samiha Sultana, Ananya Rahaman, Anita Mahmud Jhara, Akash Chandra Paul, Jia Uddin proposed a warning system that uses GSM and IOT to convey sensed data to managing authorities in order to avert such incidents before they have an impact on the public in a paper An IOT based Smart Drain Monitoring System with Alert Messages.(2021) [5]

In another paper A Real-Time Smart Wastewater Monitoring System Using IoT: Perspective of Bangladesh, Muhammed Sakib Hasan, Shahjalal Khandaker, Md. Shahid Iqbal, Md. Monirul Kabir proposed a new model for real-time Smart Wastewater Monitoring System (SWMS) in Bangladesh that makes use of the Internet of Things (IoT). Different industries have their own production schemes and use different types of chemicals and raw materials.[6]

III. PROPOSED METHODOLOGY

A. Block Diagram

The proposed methodology is based on IoT, which helps in monitoring the level and flow rate of sewage. As shown in Fig.1, it consists of an ultrasonic sensor, flow sensor, float sensor, NodeMCU ESP2866 and Arduino Uno. NodeMCU and Arduino will need a power supply. NodeMCU will be connected to the blynk app.

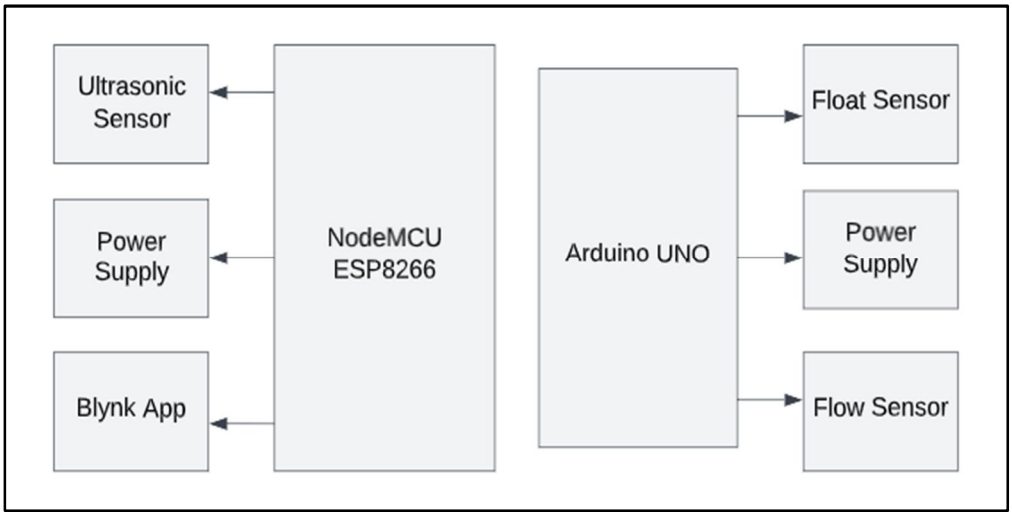


Fig.1 Block Diagram for the proposed System

B. Description

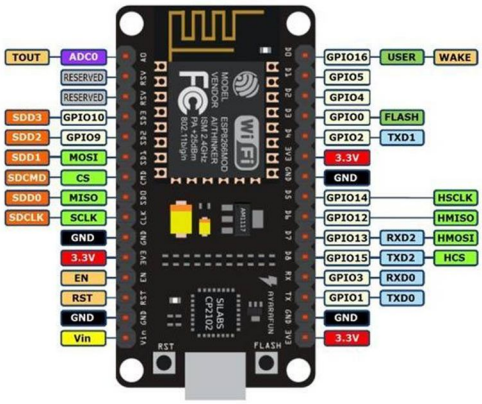
List of Components Used

Sr. No.	Component	Model No.
1	Nodemcu	ESP8266MOD
2	Arduino UNO	R3
3	Ultrasonic Sensor	HC-SR04
4	Flow Sensor	YFS201
5	Float Sensor	P43
6	Battery	9 V

1) NodeMCU Esp8266

NodeMCU is an open source IoT platform with a low cost. NodeMCU is a Lua-based open-source firmware and development board specifically for IoT-based applications.

In the proposed system, it is the main component to which the ultrasonic sensor and blynk web app are connected.



NodeMCU Esp8266

2) Arduino UNO

The Arduino UNO is an inexpensive, flexible and easy-to-use open source programmable microcontroller board that can be integrated into a variety of electronic projects.

In the proposed system, it is another main component to which the flow sensor and float sensor are connected.



3) Ultrasonic Sensor

Ultrasonic sensors generate or detect ultrasonic energy.

The electrical signal emitted by the ultrasonic signal is amplified and processed to detect reflected echoes and calculate distance from a specific target.

In the proposed system it is connected to a blynk web app through nodeMCU to monitor the level of sewage inside the tank.



Ultrasonic Sensor

4) Flow Sensor

A flow sensor or flow meter is an electronic device that measures or controls the flow rate of a liquid or gas in a pipe or tube.
In the proposed system, a flow sensor is connected to Arduino UNO to measure the flow rate of sewage.



Flow Sensor

5) Float Sensor

The float level sensor is a continuous level sensor with a magnetic float that moves up and down as the liquid level changes.
In the proposed system, a float sensor is connected to Arduino Uno to give an alert to users when the level of sewage reaches its threshold inside the tank.



Float Sensor

C. Working

The ultrasonic sensor monitors the level of sewage inside the tank. A float sensor checks whether the level of sewage inside the tank reaches its threshold or not. And the flow sensor measures the flow rate of sewage. Whenever the sewage level crosses the threshold value, the sewage workers are alerted through a blynk indicating whether it is necessary or not to clean the sewage. This system helps in monitoring sewage level through ultrasonic sensor and monitoring flow rate through flow sensor and receiving notification on sewage level reaching its threshold value, therefore helping sewage workers to take decisions for cleanliness and also maintain a healthy and disease free environment.

IV. RESULTS AND DISCUSSIONS

The system is thereby comprised with ultrasonic sensor, float sensor and flow sensor which helps to monitor the sewage. Blynk Web App is used to display the level of water in the sewer.
The flow rate of water while carrying out the experiment was observed to be in between 500 – 1360 litres/hour as shown in Fig. 3.



Fig. 2 Experimental Set Up

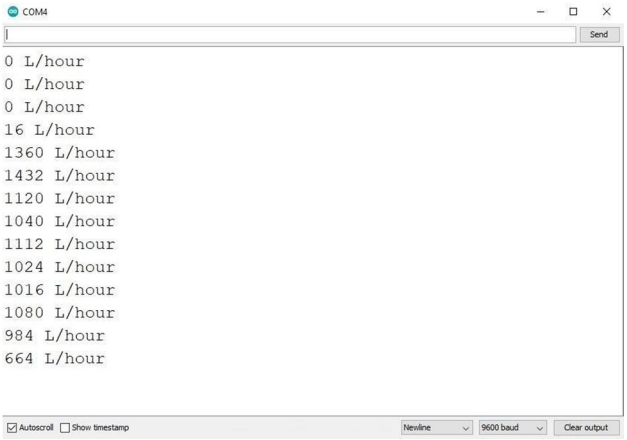


Fig. 3 Flow Rate Observation on Serial Monitor



Fig.4 Water Level and Status visualized on Blynk App

V. FUTURE SCOPE

In implementation of this project, the valve was controlled manually and also ESP8266 and Arduino were used together for implementation of the project. So furtherly project can be developed with Wi-Fi Module ESP8266 alone and implementation of automatic valve control can be done. Additionally, the project can make use of a gas sensor to detect the gas level , which may help sewage workers to decide whether it is safe to work in the environment or not.

VI. CONCLUSIONS

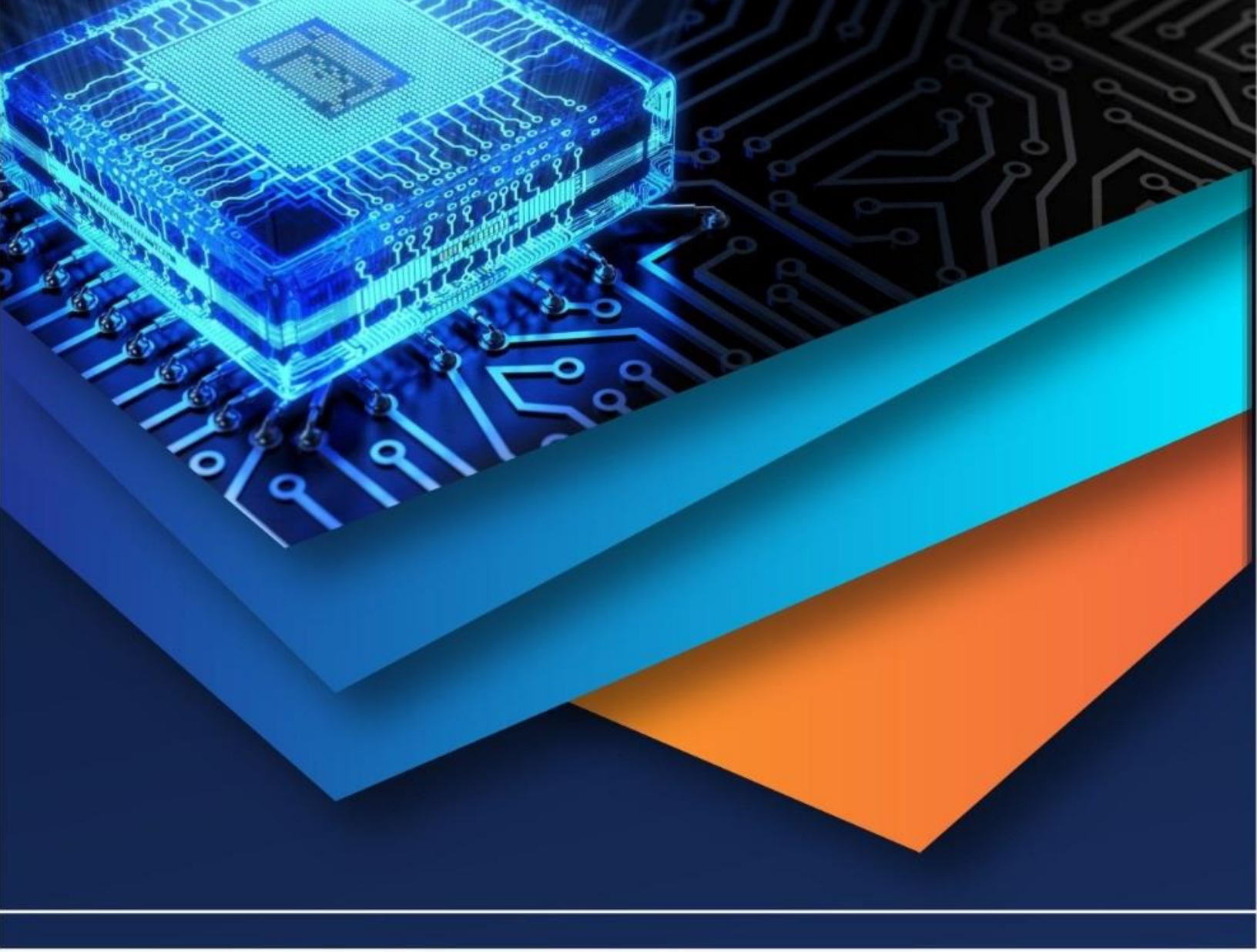
A preventative system prevents or eliminates sewage overflow on roads, which is a major concern in many communities. The ultrasonic sensors are effectively used, and the system is designed with a socially relevant concept in mind, resulting in an impact on hygiene and cleanliness by simply avoiding the problem of overflowing on streets, as well as ensuring mandatory cleaning of blockages that cause the sewage level to rise by registering repeated complaints to random departments unless action is taken.

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