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SEWAGE BLOCK IDENTIFICATION AND RESCUE SYSTEM USING WIRELESS SENSOR NETWORKS

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ABSTRACT

Drainage is the system or process through which water sewage or other liquids are removed from a location however manually monitoring all areas that a human cannot reach is extremely tough this effects the blocking of underground pipelines and water overflows cause the health issue to address all of these challenges we designed a system based on wireless sensor network WSN sensors these sensing devices are known as nodes the proposed system is low-cost low-maintenance long-lasting and web-based real-time system that alerts municipal officers via text message when any manhole reaches the threshold value this system has a direct impact on the health of citizens and workers who clean the subterranean drainage It also prevents the transmission of infection caused by mosquitoes, provides a clean and hygienic atmosphere, and controls diseases such as malaria, dengue fever, and diarrhea. The technology lowers the number of accidents caused by uncovered manholes.

KEYWORDS: *WSN, Web-Based Real-Time System*

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1. INTRODUCTION

Drainage should be examined on a regular basis to ensure good operation. It is also impossible to monitor all locations due to human limitations. These issues can be addressed with the use of Wireless Sensor Networks (WSN) [1], a Monitoring technology consisting of low-power sensor nodes. Sensor node [2] comprises a controller, memory, transceiver, and battery to provide power to the sensor node. The sensor node's size is determined by its use. The node gathers information from its surroundings and transmits it to a base station. The primary rationale for using WSN is for continuous monitoring of environments where humans cannot reach to record readings.WSN systems [1], [2] are more efficient than fixed line systems in terms of cost, flexibility, and dependability.

This document discusses the design of drainage systems for monitoring of conditions through the use of a network of wireless sensors. The sensors will be deployed at the mouth of the canal and will transmit the data on the condition of the drainage to the cloud (base station) and to the city's mobile phone [3]. The parameters are monitored using the water levels in the drain, the humidity and the temperature of the drain access mouth.

2. HARDWARE DESIGN

The wireless sensor network is utilized in a variety of applications, one of which is the underground drainage/sewage monitoring system. The key research concern in WSN is energy consumption, which can be addressed by implementing node-level energy savings. The Node Sensor is required to collect surrounding parameters, as well as the hardware and software required, should be energy efficient. The ATmega328 microcontroller is employed as a core element in this design to fulfill the requirements of all sensor node functions. The ATmega328 is a low-power, high-performance controller. The sensor receives a signal from the environment, and the original signal is processed by the controller before being sent to the base station.

2.1. Sensors of System

2.1.1 Temperature Sensor

The DHT11 temperature sensor is a digital sensor that measures real-time temperature and humidity and sends digital data to the controller.

2.1.2 Ultrasonic Level Sensor

The ultrasonic sensor HC-SR04, like bats, uses sonar to assess how distant an item is from it. It enables exceptional non-contact range detection with great precision and consistency.

2.1.3 Light Sensor

To determine whether a shaft is closed or open. The sensor detects the threshold value when a shaft is opened and transmits the information to the controller. In the meantime, this periodically transmits the real-time data to the base station.

2.2 System Architecture

The sensor node in this system is made up of four components: a GSM (Global System for Mobile Communication) module acting as the transceiver [3], an Arduino serving as the microcontroller, a sensor, and a battery. This sensor transmits data to Arduino, which then sends the real-time information to Municipal Corporation Mobile via GSM for cloud-based display. According to where the manhole is, the nodes are implemented [4]. Since the node can be identified by its address, the city government can quickly identify any node sending data that is in excess of the expected reading and take appropriate action. The base station is a crucial component of the WSN. It is fast, has a lot of memory, and more processing power. Processor and it is often connected to a larger energy source than batteries of the normal sensor node.

In our situation the base station is nothing more than a cloud that collects data from all sensor nodes in the network via the GSM modem and makes it available to a standard computer linked to the internet using this technology the person sitting in the control room may view real-time readings on the cloud over the internet and review the history of nodes.

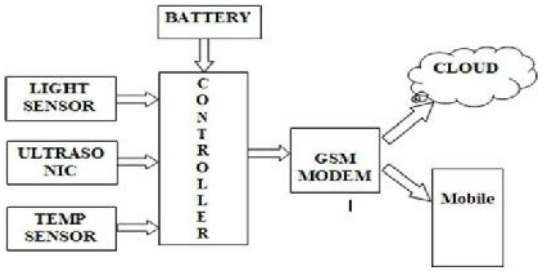

Figure 1: Block Diagram.

3. HARDWARE COMPONENTS

3.1 Arduino UNO

Arduino is an open-source initiative that developed microcontroller-based kits for the creation of digital gadgets and interactive objects capable of sensing and controlling physical devices the project is based on microcontroller board designs created by several manufacturers and employing numerous microcontrollers these systems feature sets of digital and analogue input output io pins that may interact with various expansion boards called shields and other circuitry the boards provide serial connection ports including universal serial bus USB on some variants for loading applications from personal computers for programming microcontrollers the Arduino project provides an integrated development environment IDE based on the processing programming language which additionally supports the languages c and c the Arduino UNO is a microcontroller board based on the ATmega 328p it contains 14 digital input output pins 6 of which may be used as PWM outputs 6 analogue inputs a 16 MHz quartz crystal a USB connection a power connector an ICSP header and a reset button.

3.2 Ultrasonic Sensor

When it launches, an ultrasonic transmitter generates an ultrasonic wave that travels in just one direction. The item reflects the transducer's sonic waves, which are then returned to the transducer. The ultrasonic sensor will switch to reception mode after releasing the sound waves. The distance of the item from the sensor affects how long it takes for a signal to travel between emitting and receiving.

3.3 DC Fan

A DC fan is a device that many systems employ to cool down. When a gadget receives a supply, it begins to rotate. Reversing the supply will change the fan's direction. The principle behind how a DC (direct current) fan operates is that when a conductor carrying current is put in a magnetic field, it feels a torque and has a propensity to move. The fan features a DC brushless motor with a rated 360mA and a 5V operating voltage. It is vitally necessary to be aware of this behaviour while developing the electronics that connect with a DC brushless cooling fan.

3.4 Gas Sensor MQ2

The sensitive SnO_2 material used in the construction of the MQ-2 gas sensor has a reduced conductivity in clean air. The sensor's conductivity increases in the presence of the target flammable gas. The change in conductivity is converted using a signal conditioning circuit such that the output signal matches the input gas concentration. The MQ-2 gas sensor is inexpensive, versatile, and very sensitive to LPG, Propane, and Hydrogen. It may also be used for Methane and other flammable gases. An operational voltage of 5VDC is used by the PCB board on which the MQ-2 gas module is installed. Analog and digital methods can both be used to obtain the sensor output values.

3.5 SIMCOM GSM/Voice Modem

Similar to a mobile phone with a personal phone number, this GSM modem may operate with any GSM network operator SIM card. The RS232 port on this modem may be utilized for communication and creating embedded programmes, which is a benefit of employing it. The modem may be linked directly to the serial port of a PC or through MAX232 to any microcontroller. Both voice calls and SMS may be made and received with it. Additionally, it may be used in GPRS mode to access the internet and run a variety of data recording and control programmes. The SIM800C is a full-featured dual-band GSM/GPRS solution in an SMT module with an industry-standard interface, while the SIM800CS is a quad-band GSM/GPRS module that operates on frequencies GSM850MHz and provides performance for voice, SMS, Data Small device factor and low power consumption for fax.

3.6 7805 IC Voltage Regulator

A regulated power supply is very important for various electronic devices because the semiconductor material used in them has a fixed current and voltage rating. The unregulated output is fixed at a constant voltage with the help of a DC voltage regulator. The circuit consists of a 7805 linear voltage regulator and capacitors and resistors with a bridge rectifier of diodes. The IC Regulator is mainly used in the circuit to maintain the exact voltage that the power supply follows. A regulator is mainly used with the capacitor connected in parallel with the input terminal and output terminal of the regulator IC. Capacitors are used to check for gigantic noise in both the input and output filters. While the bypass capacitors are used to check the small period peaks in the input and in the amplifier; Output level.

C1 This capacitor, often referred to as a bypass capacitor, is used to send very brief spikes to the ground without endangering the other parts. The filter capacitor

C2 Is used to stabilise the gradual fluctuations in the voltage delivered at the circuit's input.

C3 Is a filter capacitor that is used in the circuit to stabilize the output voltage's gradual changes. The bypass capacitor,

C4 was used to bypass extremely brief spikes to the ground without affecting the other parts

The IC with positive DC, U1, maintains the output voltage precisely at a constant value despite significant input voltage variations. We must utilise an IC regulator for 5V DC because we designed the entire circuit to run off of a 5V DC supply. The 7805 is the IC regulator that is used the most frequently for 5V DC regulation. As a result, we are included the same IC in the circuit as U1.

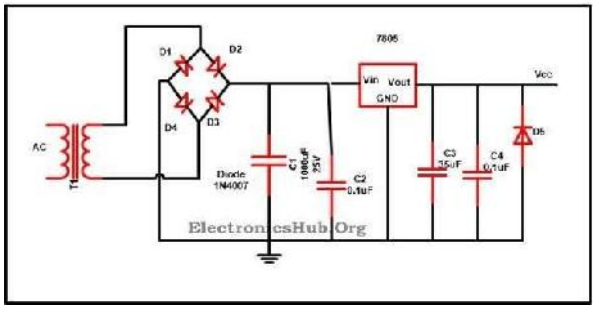

Figure 2: 7805 Voltage Regulator.

4. SOFTWARE COMPONENTS

4.1 Embedded 'C' Language

Supporting advanced microprocessor features like fixed-point arithmetic, several different memory banks, and fundamental I/O operations often necessitates nonstandard additions to the C language.

4.1.1 Working Description

A wireless system based on an Arduino UNO module processes analogue data from three different detectors, checks it, and if any sensor has exceeded a predetermined threshold value, sends a message via a GSM module to the relevant municipal authority and the cloud.

The sensor node is installed essentially in every hole with three different sensors to monitor its condition: the first and most important is the water level; the second is the manhole's temperature; and the third is the amount of weight inside the manhole.

The light sensor is used in three ways: I to prevent leaving manholes open; (ii) to prevent actions being taken; and (iii) to prevent accidents brought on by the open manhole. For temperature, weight, and water level sensors, the programme allows for the setting of all threshold values. The system has three completely different threshold conditions, and if any of them are satisfied, GSM can send a message to the authorised person. When we implemented the system for eight manholes in a three-klick area, we received text messages indicating that we needed to clean the manholes, the temperature had increased, and the manhole was open. Additionally, the data is stored in the cloud at the same time.

The designated individual will look up the crucial time information online. On websites, the condition of the manhole is highlighted in red once any hole crosses the brink price.

5. CONCLUSION AND FUTURE WORK

This proposed approach takes into account the direct influence on voters health issues caused by the workers who maintain the subterranean evacuation system it creates a clean hygienic environment prevents the transmission of disease caused by mosquitoes and manages conditions including malaria dengue fever diarrhea and other illnesses because of the aforementioned system the maintenance value might be reduced from a central position it will keep an eye on the congestion in the drainage pipes additionally it lessens accidents brought by exposed holes it would be helpful to resolve the issues with clogged drains overflowing manholes and seasonally major hygiene maintenance Arduino-based wireless sensor networks achieve our projects goals of low cost extended range and increased network longevity this project may be utilized in systems for monitoring and regulating agriculture crops and the environment with a minor update to the algorithm

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