IoT BASED UNDERGROUND DRAINAGE MONITORING SYSTEM

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ABSTRACT

A good drainage management is a symbol of good city. Now-a-days man-holes are the main problem in the cities. All the man-holes are not in secure position. Most of the drainage are in damaged condition. Because of the damaged drainage, there are chances of occurrence of accidents in the road. These damaged man-holes will be a threat to personal safety. Our project work is to design an effective accident avoid system by preventing open drainage in major cities. The sensors like tilt sensor and weight sensor used to detect the crack and the damage in the drainage cover and then the information will be sent to the authority of the corporation department and the councillor of the area where the drainage is present. The control and the maintenance are made through Internet of Things. The implementation of this project will be very useful to the society.

Introduction

Drainage Monitoring System: - Drainage may consists of the wastes left over from City, Public area, Society, College, home etc. Leakage of the drainage water can cause severe effects on environment. This project is related to the "Smart City" and based on "Internet of Things" (IOT). So, for smart lifestyle, cleanliness is needed, and cleanliness is beginning with Drainage maintenance. It will help to reduce road traffics, toxic gas leakage. The Internet of Things (IoT) is a recent communication paradigm that envisions near future, in which the objects of everyday life will be equipped with micro controllers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet. It is a very innovative system which will help to keep the cities clean. This system monitors the Manhole and informs about the level of Drainage water level and gas and humidity level. For this the system uses ultrasonic sensors placed over the manhole cover to detect the water and gas level and compare it with the drainage depth. The system makes use of Arduino family microcontroller, LCD screen, Wi-Fi modem for sending data and a buzzer. The system is powered by a 12V transformer. The LCD screen is used to display the status of the level of water, humidity and gas. Whereas a web page is built to show the status to the

user monitoring it. The web page gives a graphical view of the drainage. The LCD screen shows the status of the drainage water level, gas and humidity level. The system puts on the buzzer when the level

of water crosses the set limit. Thus, this system helps to keep the city clean by informing about the drainage water levels by providing graphical image of the drainage via a web page.

Keywords

IoT, LED Display, Water level Sensor, MQ2 Sensor, Tilt Sensor, DHT11 Sensor, GPS, ESP32 Cam

Related Work

Sunidhi Vashisth, Sunil Kumar Chawla, Bharti Mahjan and Himani Chugh et al, presented an Internet of Things for Smart Environment Applications. Internet of Things (IOT) is becoming an emerging technology due to the rapid use of internet. IOT is a kind of "universal global network" that combines different things such as mobile, laptop, notepad etc. IOT is a smartly integrated system that interacts with other machines, environments, objects and infrastructure that comprises intelligent machines including radio frequency identification (RFID) and sensor network technologies. In every company, the people send email and access websites, or other online means, but in most countries, the internet is available to transmit data across mobile devices and the Internet through easier, faster, and less costly systems. The main purpose of this object is to provide the detailed study about IOT along with its applications in different field such as health, urban city, industry, transportation and smart building.

Muhammad Irsyad Haziq, Ilanur Muhaini Binti Mohd Noor and Raed Abdulla et al, presented a Smart IoT-based security system for residence The main aim is to develop an IoT based security system for resident which include biometric authentication, plate recognition, and movement detection system. In this proposed method, the programming platforms such as the Python, and the Arduino, were used to develop to demonstrate the proposed system. The performance of the developed proposed system is evaluated by testing the system with several sample tests and from

there, the performance was examined. The system performed well in recognizing the different person and capable of returning the correct output in almost all the face samples as well as the plate number detection which can successfully extract the string information from the pictures. It is observed that the system has an overall accuracy of 77% after considering several important factors that may affect the system's performance. The proposed systems used off the shelf components as a proof of concept. The proposed systems were validated based on: a) the range of the temperature found beneath a manhole cover, and b) the signal reconstruction under the presence and the absence of noise. The results show decent performance of the proposed system from the power consumption point of view, as it can exceed the lifetime of similar two pumps based Jerk chaotic oscillators by almost one year for long lifetime applications such as using LiIon battery. Furthermore, in comparison to PRNG output sequence monitoring MC e generated by a software algorithm used in AIC framework in the presence of the noise, the first proposed system output sequence improved the signal reconstruction by 6.94%, while the second system improved the signal reconstruction by 17.83 %.

Towards the Implementation of IoT for Environmental Condition Monitoring in Homes Author: Kelly S.D.T, Suryadevara, N.K, Mukhopadhyay S.C

Description:

In this paper, we have reported an effective implementation for Internet of Things used for monitoring regular domestic conditions by means of low-cost ubiquitous sensing system. The description about the integrated network architecture and the interconnecting mechanisms for reliable

measurement of parameters by smart sensors and transmission of data via internet is being presented. The longitudinal learning system was able to provide self-control mechanism for better operations of the devices in monitoring stage. The framework of the monitoring system is based on combination of pervasive distributed sensing units, information system for data aggregation, reasoning and context awareness. Results are encouraging as the reliability of sensing information transmission through the proposed integrated network architecture is 97%. The prototype was tested to generate real-time graphical information rather than a test bed scenario.

Monitoring Smart City Applications using Raspberry PI Based on IOT Authors: Prof. S A.Shaikh , Suvarna A. Sonawane.

Description:

The Smart city is the development goal to monitor the quality of resource in the city to improve good management and faster development of the city required necessity is to upgrade healthy and safe cities that delivering real time services and latest facility to implement the concept of smart city use IoT concept by which easy wireless communication is possible. The system consists of sensors, collect different types

of data from sensors and transfer to the Raspberry Pi3 controller. The acquired output from the controller is sent to the control room through the E- mail and also display on the personal computer.

The design space of wireless sensor networks, Wireless Communications Author: Romer, K. Mattern

Description:

In the recent past, wireless sensor networks have found their way into a wide variety of applications and systems with vastly varying requirements and characteristics. As a consequence, it is becoming increasingly difficult to discuss typical requirements regarding hardware issues and software support. This is particularly problematic in a multidisciplinary research area such as wireless sensor networks, where close collaboration between users, application domain experts, hardware designers, and software developers is needed to implement efficient systems. In this paper we discuss the consequences of this fact with regard to the design space of wireless sensor networks by considering its various dimensions. We justify our view by demonstrating that specific existing applications occupy different points in the design space.

Existing System

The issue of poorly managed and stolen gas well covers is becoming an alarming situation in different countries. The existing manhole cover systems are found to be covering single monitoring parameters have immature technology and contain inefficient analysis capabilities to find and eradicate issues regarding manhole covers and security. The traditional methods of manhole cover protection and monitoring can't cope with the challenges of increasing population and underground infrastructures. Therefore, there is a need to develop more automatic systems of monitoring.

Drawbacks

- ✓ Whenever a problem occurs it's not notified to the government directly.
- ✓ As a result, monitoring is not achieved effectively.
- ✓ No communication is done and hence maintaining the manhole may be a question mark.

Proposed System

- ✓ Detection of drainage water level and blockages in the drainage.

✓ Checking water flow rate continuously, as well as sending automatic mail, display on the monitor if the water level is outside of an expected normal range.

✓ The main objective is to obtain an effective low-cost and flexible solution for condition monitoring and infrastructure management in the city.

✓ Sensing the temperature and leakage of gas and updating it in real time through IoT.

Merits

✓ Whenever a problem occurs, it's get notified to the government directly.

✓ This may also increase the confidence for the government.

✓ Camera is used for monitoring Virtually.

Module Description

A module is a Hardware and software component or part of a program that contain one or more routines.

ARDUINO UNO

The Microcontroller used here is an Arduino UNO. The UNO is a Microcontroller board based on ATMEGA 328P. The ATMEGA 328P has 32kB of flash memory for storing code. The board has 14 digital input and output pins, 6 analog inputs, 16 MHz quartz crystal, USB, an ICSP circuit and a reset button. The UNO can be programmed with the Arduino software.

SENSORS

a sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes depends upon transducer in its environment and send the information to other electronics, frequently a microcontroller. A sensor is always used with other electronics.

ESP8266 WIFI

The ESP8266 arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability, and the amazing thing is that this little board has a MCU (Micro Controller Unit) integrated which gives the possibility to control I/O digital pins via simple and almost pseudo-code like programming language. This device is produced by Shanghai-based Chinese manufacturer, Espresso if Systems.
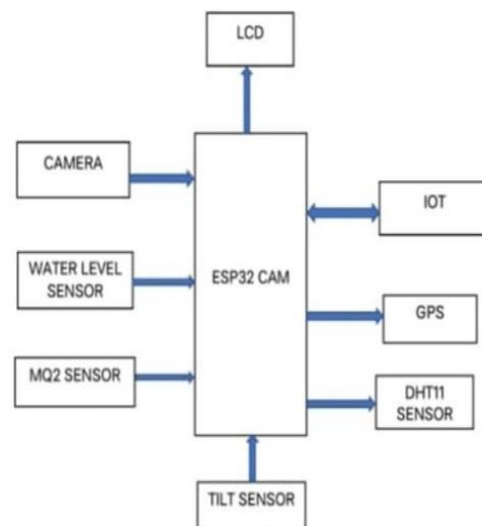

Results and Discussion

LED Display

An LED display consists of many closely-spaced LEDs. By varying the brightness of each LED, the diodes jointly form an image on the display. To create a bright colour image, the principles of additive colour mixing are used, whereby new colours are created by mixing light in different colours. An LED display consists of red, green and blue LEDs mounted in a fixed pattern. These three colours combine to form a pixel. By adjusting the intensity of the diodes, billions of colours can be formed. When you look at the LED screen from a certain distance, the array of coloured pixels is seen as an image.
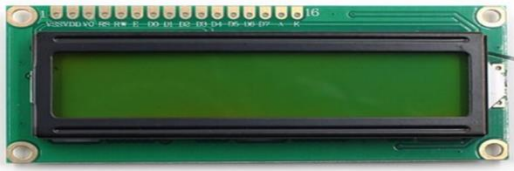
Water level Sensor

It's a device that measures the high or low level of a liquid in a fixed vessel. According to the method of liquid level measurement, there are two types of contact and non-contact. What we call input water level transmitter is a contact measurement, which converts the height of liquid level into electrical signal output. It is a widely used water level transmitter at present.
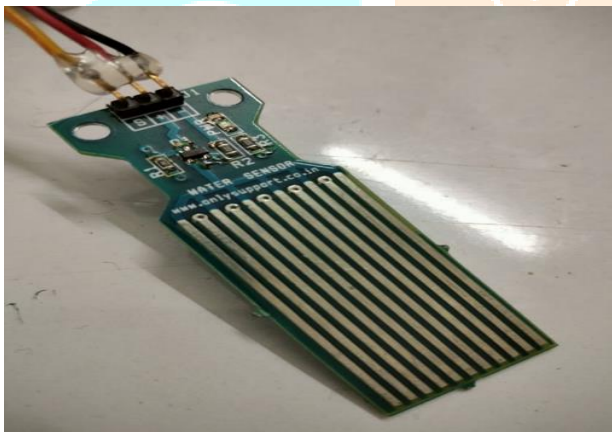

MQ2 Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. MQ2 gas sensor is also known as chemi resistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.


Tilt Sensor

A tilt sensor has a metallic ball that is designed to move the two pins of the instrument from the 'on' to the 'off' position, and vice versa, if the sensor reaches a pre-determined angle. Tilt sensors are the environment-friendly version of a mercury-switch. Tilt sensors are devices that produce an electrical signal that varies with an angular movement. These sensors are used to measure slope and tilt within a limited range of motion. Sometimes, the tilt sensors are referred to as inclinometers because the sensors just generate a signal but inclinometers generate both readout and a signal.
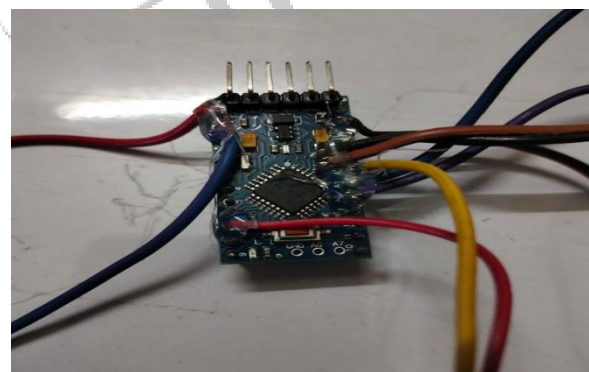
DHT11 Sensor

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The

IC measure, process this changed resistance values and change them into digital form.
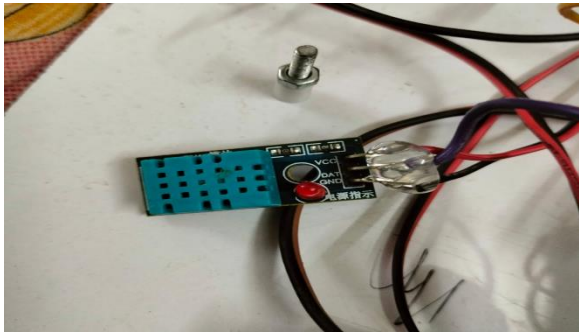
GPS

GPS (Global Positioning System) is a satellite-based navigation system. It provides time and location-based information to a GPS receiver, located anywhere on or near the earth surface. GPS works in all weather conditions, provided there is an unobstructed line of sight communication with 4 or more GPS satellites.

ESP32 Cam

ESP32-CAM is a low-cost development board with WiFi camera. It allows creating IP camera projects for video streaming with different resolutions. ESP32-CAM has built in PCB antenna.

Gas and humidity sensor:

The humidity sensor is a device that senses, measures, and reports the relative humidity (RH) of air or determines the amount of water vapor present in gas mixture (air) or pure gas. Humidity sensors vary widely in size and functionality; some humidity sensors can be found in handheld devices (such as smartphones), while others are integrated into larger embedded systems (such as air quality monitoring systems).

An underground drainage monitoring system will not only help in maintaining the proper health and safety of the city but also in reducing the work of government personnel. Various types of sensors (flow, level, temperature and gas sensors) are interfaced with microcontroller Arduino Uno in order to make the system smart. When the respective sensors reach the threshold level, the indication of that respective value and sensor is being sent to the microcontroller. Furthermore, Arduino Uno then sends the location of the manhole to the municipal corporation through GPS and the officials could easily locate which manhole is having the problem and could take appropriate steps. Also, Arduino Uno updates the live values of all the sensors in the manholes falling under the respective area using IoT. A message will also be displayed on the LCD.

The sensor detects two statuses of the manhole cover- open or closed. During installation, the sensor is sticking out of the manhole surface, indicating the manhole is in "opened" status. After the manhole cover is placed on it, the sensor is bending over,

knowing now the manhole is in "closed" status. The System will glow LED when the manhole cover is Removed or slide or open.

The system contains three users:

1. Admin

2. Worker

3. Secretory

• The admin can add worker and secretory also check the status of man- hole and also the flag status over the manhole. Admin also checks the Feedback given by secretory. Admin can provide shortest path to worker.

• Admin can provide shortest path to the worker in following ways:

1. Shortest Path Between the manholes.

2. Shortest Path Between BMC Worker and Manholes.

• Worker check the status of manhole and also check the shortest path provided by Admin and take action regarding it.

• Secretory gives the feedback about the manhole status in that particular area of him/her.

The system consists of small battery-powered devices that are mounted to the manholes or any other infrastructure that can be opened or closed with a limit switch. Each opening and closing of the is noted by sensors located in the gateway. These, via standardized communication protocols (NB-IoT or LTE Cat. M1) send an event signal to the IoT platform (Comarch IoT Platform or other). Then, data are received, processed and analysed. On this basis, the platform can send alerts to the customer and generate reports. Importantly, it can also be integrated with other Comarch or external IT systems (such as Comarch FSM, which is used to manage the work of field employees).
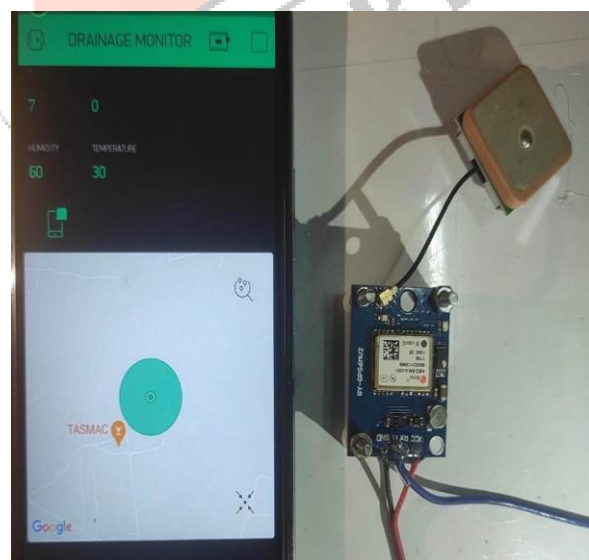
Conclusion and Future Work

The invention discloses a road manhole cover monitoring device based on an IOT (Internet of Things) technology. The device comprises a ESP8266 chip device, an IOT scanning antenna device, a voice prompt device, a charge coupled device (CCD) camera shooting acquisition device and an alarm device. The data output end of the ESP8266 chip device is connected with the data input end of the IOT scanning antenna device; the output end of the IOT scanning antenna device is connected with the data input end of the voice prompt device; the data

output end of the voice prompt device is connected with the data input end of the CCD camera shooting acquisition device; the data output end of the CCD camera shooting acquisition device is connected with the alarm device. According to the device, whether an underwater manhole cover or a communication manhole cover is abnormally moved or not can be accurately detected, the safety of traveling personnel is guaranteed, the state property losses are avoided, and the device has the advantages of high data transmission speed, low cost, safety, reliability and the like.

The traditional methods of manhole cover protection and monitoring cannot cope with the challenges of increasing population and underground infrastructures, therefore, there is a need to develop more automatic systems of monitoring.

Detect the location

• The system governing the flow of sewage from the pipes.

• Use of flow sensors to detect the variations in the flow.

• Get the prior alerts of blockages and locate them using IOT.

• Trace location using GPS.

The smart Manhole system will have: Sensors to detect blockage, flood and gases. Sensors will identify the gases and blockage inside the drainage system and will generate message of the location and other information and updated to the app. The system will also sense the harmful gases such as Methane (CH4), Sulfur dioxide (SO2), Carbon monoxide (CO) etc inside the manhole. As the level of such gases and water the increases the system will glow LED and send information to system. These entire data will be collectively sent by the WIFI stored at the Google cloud all these data will be show on the app.

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