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Smart Cities through IoT

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Abstract: ***The enormous utilization of Internet of Things (IoT) is allowing Smart City projects and initiatives all over the world. The IoT is a modular approach to merge various sensors with all the solutions. Due to the advancements in technologies, smart cities have been considered as a versatile parameter in order to control, monitor and operate in different fields (like electrical fault detection, corporation duties etc.) in an efficient manner without costing much of time and manpower thereby making the city smarter than before.***
Cities can be interfaced with Internet of Things(IoT) which finds many applications in the conversion of a city to a Smart City. In this paper, a sincere attempt has been taken to list out the essentials of Smart Cities and to overcome the issues faced by normal cities. Also, the main purpose of this paper is that of providing a detailed review on the concepts of smart cities and their applications in different fields. In particular, this concept describes the IoT technologies for smart cities and the main features of a smart city.
Keywords: Internet of Things(IoT), smart city, environment, sensors, electrical system.

I. INTRODUCTION

The heart of smart cities operations is the IoT communications. IoT is designed to support Smart City concept, which aims at utilizing the most advanced communication technologies to promote services for the administration of the city and the citizens.The Internet of Things is an infrastructure that includes physical devices, modern vehicles, buildings, and even essential electrical devices which we use on a consistent basis inter-connected to each other over the internet so that they can accumulate and exchange data amongst themselves.
These "Things" have the priority and the ability to self-organize and communicate with other things without human intervention. There are more than six devices connected to the Internet per person. The concept of IoT aims to present the Internet even more pervasive and even more immersive.
Moreover, by enabling easy access and interaction with an extensive variety of devices such as instance for home appliances, monitoring, surveillance cameras, sensors, displays, actuators, and vehicles. The IoT will improve the development of various applications that make use of the massive amount and diversity of data produced by objects to implement further services to companies, citizens, and public administrations.
With IoT it is possible to remotely access anything(e.g., sensors, actuators etc.,), anywhere, anytime without the use of manpower while providing facilities to the inhabitants of the city.
A common characteristics of existing approaches is that actions do not take place on time and negligence is way too more. Life could become more easy and flexible by implementing this technology in our daily lives. With the help of particular sensors particular faults or abnormalities could be detected and the corresponding status shall be sent to the authorized person who can assign his assistants to look after the issue.

II. PROBLEM STATEMENT

We have seen in the number of cities where proper and immediate care is not taken against abnormalities like water pipeline leakage, drainage overflow, garbage overflow, water supply problems and also against electrical issues like cable breaks, line-line fault, earth fault etc. IoT is one of the possible solutions to minimize these issues.

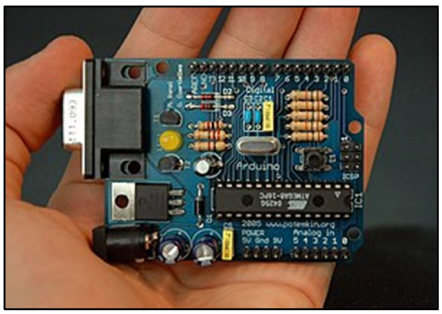
Advantages of the proposed system
1) Maintenance cost reduction.
2) Wireless communication
3) Reduction of manpower.

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III. COMPONENTS REQUIRED

A. Software components

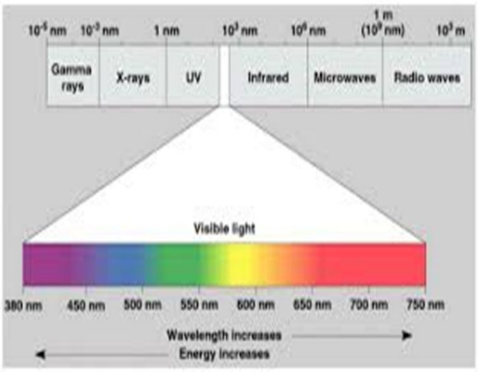
Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. The Arduino IDE is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring project.



ARDUINO SKETCH 1.6.12: this involves PCB designing and burning the module as per our requirements.

B. Hardware components

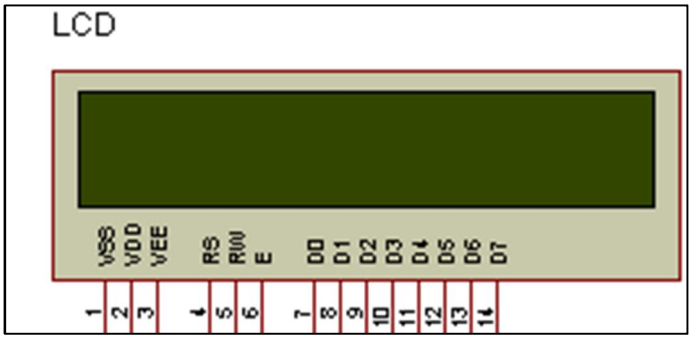
1) *IR Sensor* : Infrared (IR) light is electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 0.74 micro-meters (μm) to 300 μm. This range of wavelengths corresponds to a frequency range of approximately 1 to 400 THz, and includes most of the thermal radiation emitted by objects near room temperature. Infrared light is emitted or absorbed by molecules when they change their rotational-vibration movements. Infrared light is used in industrial, scientific, and medical applications. Night-vision devices using infrared illumination allow people or animals to be observed without the observer being detected. In astronomy, imaging at infrared wavelengths allows observation of objects obscured by interstellar dust. Infrared imaging cameras are used to detect heat loss in insulated systems, to observe changing blood flow in the skin, and to detect overheating of electrical apparatus.



2) *Capacitors:* The function of capacitors is to store electricity, or electrical energy. The capacitor also functions as filter, passing AC, and blocking DC.



3) *LCD*: LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.



4) *LDR:* The light dependant resistor is an electronic component whose resistance decreases with increasing light intensity. It is also called as "Photo Resistor" or "Photo conductor" The light dependant resistor uses high resistance semiconductor material. (Cadmium Sulphide).When light falls on such a semiconductor the bound electrons [i.e. Valence electrons] get the light energy from the incident photos.

Other hardware components like LDR,, relays, diodes, transformers and transistors are also used.

IV. BLOCK DIGRAM

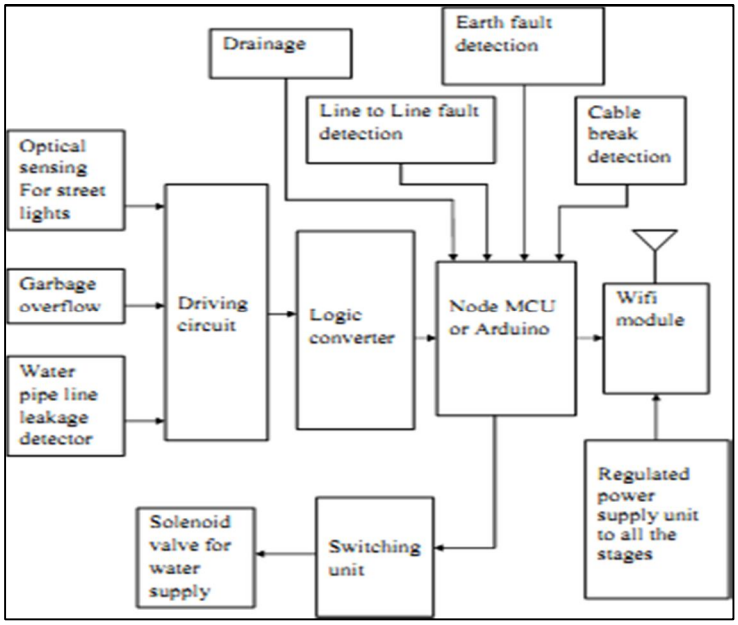


Fig. Block diagram of proposed model.

1) Regulated Power Supply: Regulated power supply is used to maintain a fixed set voltage. Here, 7805 regulator is used so as to provide 5V DC at its output side.
2) *Transformer:* A centre tapped 9-0-9V, 1A transformer and 750mA transformer are used in order to step down the high AC 230V to 9V AC.
3) *Rectifier:* This converts AC to pulsating DC. Here, a full wave rectifier and a bridge wave rectifier are used.
4) *Op-Amp:* Op-Amp is operated as comparator which compares the reference signal with the actual signal.
5) *Relay:* Relay is used for switching purpose.

V. METHODOLOGY

Initially 230V AC is converted to 9V AC with the help of step down transformer. The reduced voltage is then given to the rectifier in order to get DC equivalent of it. It is to be noted that ESP8266 chip requires 5V DC. Therefore the 9V DC is to be converted to 5V DC. This can be achieved by placing a 7805 voltage regulator in between rectifier and the chip.

Now considering the case of „Garbage Overfill", here a light dependant resistor (LDR) is used. The resistance of LDR is the function of light. The characteristic of LDR is that its resistance is low when the light is incident on it and vice versa. i.e., LDR is inversely proportional to the light. Initially a ray of light will be incident on LDR continuously (when the garbage is not filled). As garbage goes on filling, from a certain level the light won"t be detected by LDR because of the garbage that acts as obstacle in between the light source and the LDR. In this case, the resistance becomes high and is sensed by the comparator. Comparator compares the reference value to the obtained value. If the obtained voltage is less than the reference voltage then the comparator sends a signal to the chip which then alerts the authorized person. The same concept lies behind the „Street light failure". Below is the control side of the proposed model in normal working condition (left) and during any fault (right).

Now considering the case of „Water leakage detection", Here wire mesh is employed around the underground water pipe and the circuit is open. When the water leakage occurs, it closes the circuit. Hence the comparator senses the signal and sends it to the chip. The chip takes further actions as described earlier. The same principle holds good in the case of „Drainage overfill" case. The paper also helps in detecting different electrical faults like cable break, line-line fault and earth leakage.

Improper and non uniform distribution of corporation water can also be eliminated by the implementation of IoT on solenoid valves of respected area. With this, it is possible to supply water to the consumers for a particular period with just one click on smart phone without the actual usage of man power.

VI. ADVANTAGES AND DISADVANTAGES

A. *Advantages*

1) Less man power.
2) WiFi and Ethernet based system.
3) More accuracy in finding the fault location.
4) Because of immediate action, less damage and losses.

B. *Disadvantages*

1) Heavy investment.
2) Maintenance cost is high.
3) Needs internet every time
.

C. *Applications*

1) Garbage overflow indication.
2) Electrical fault clearance.
3) Water pipeline breakage detection.
4) Water supply automation.
5) Drainage overfill indication.

VII. CONCLUSION

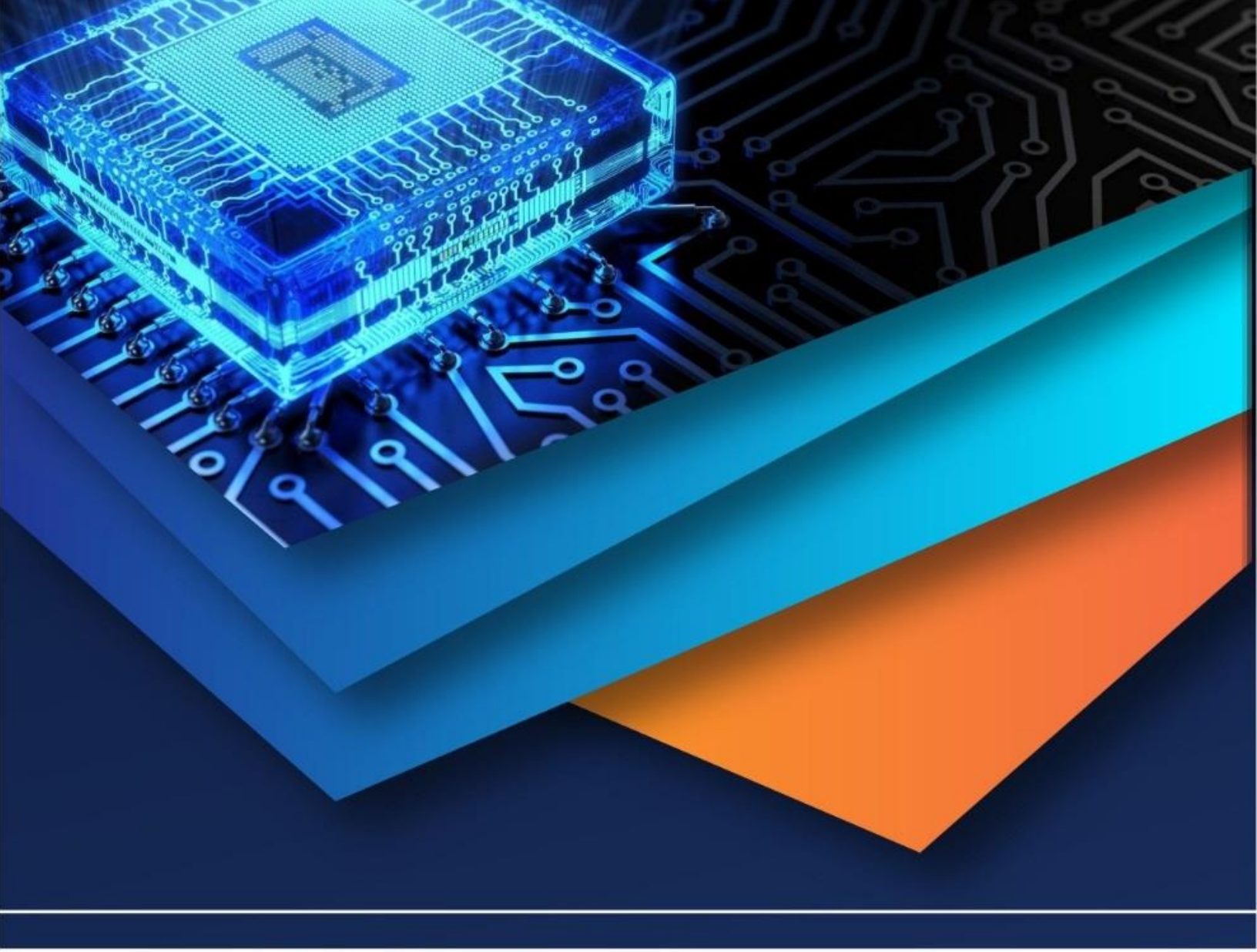
Though the investment cost for these techniques to be implemented in cities is pretty much, it can help reducing manpower for the same. One should also admit the fact that our project will result in an environmental friendly, quick responding, disciplined and tidy atmosphere all around the city. However, a proper internet connection is mandatory. Besides that, everything shall be at one"s finger tips. Our project encourages "Make in India" and "Swachh Bharat" as well.

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