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IoT Based Controlling and Monitoring of Smart City

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ABSTRACT: 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 [1]. In particular, this concept describes the IoT technologies for smart cities and the main features of a smart city.

KEY WORDS: Internet of Things(IoT), smart city, environment, sensors, electrical system, smart phone.

I. INTRODUCTION

Over a past few decades, the emergence of technology and the ability to monitor and control things remotely has attracted researchers. Such needs are abundantly contributing to establish the concept of Internet of Things – IoT. IoT has enabled the deployment of many SC applications and there are both research projects and many commercial products dedicated to such applications. The literature reveals a variety of efforts to employ "Smart Objects" (SOs) for traffic and environment monitoring [3]. 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

- Maintenance cost reduction.
- Wireless communication.
- Reduction of manpower.

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III. COMPONENTS REQUIRED

A. Software components

- **ARDUINO SKETCH 1.6.12:** this involves PCB designing and burning the module as per our requirements.
- **Blynk:** Blynk is an Android friendly app installed in an authorized person's smart phone that monitors and controls various issues.

B. Hardware components

- **NodeMCU**: The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lau Scripting language. It is based on the Lau project, and built on the Espressif Non-OS SDK for ESP8266.
- **ESP8266 Chip**: ESP8266 is a chip with which manufacturers are making wirelessly networkable microcontroller models. It has 64kb ROM, 64kb instruction RAM and 96kb data RAM.

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

IV. BLOCK DIAGRAM

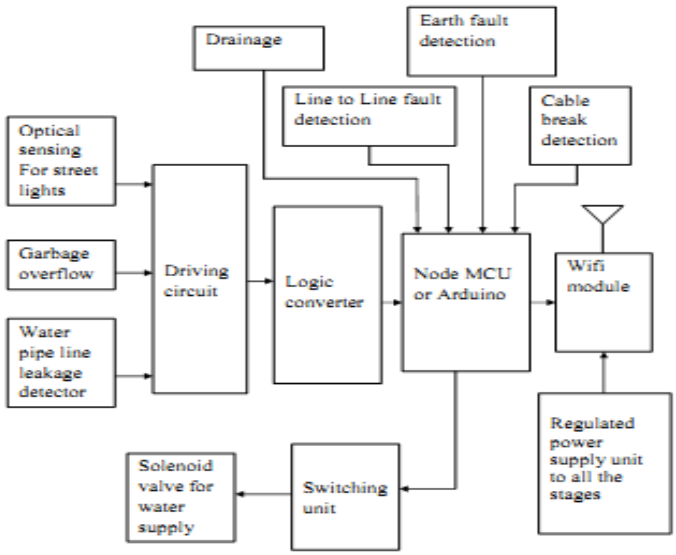

Fig. 1 Block diagram of proposed model.

A. 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.
B. 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.
C. Rectifier: This converts AC to pulsating DC. Here, a full wave rectifier and a bridge wave rectifier are used.
D. Op-Amp: Op-Amp is operated as comparator which compares the reference signal with the actual signal.
E. Relay: Relay is used for switching purpose.
F. NodeMCU: NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

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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.

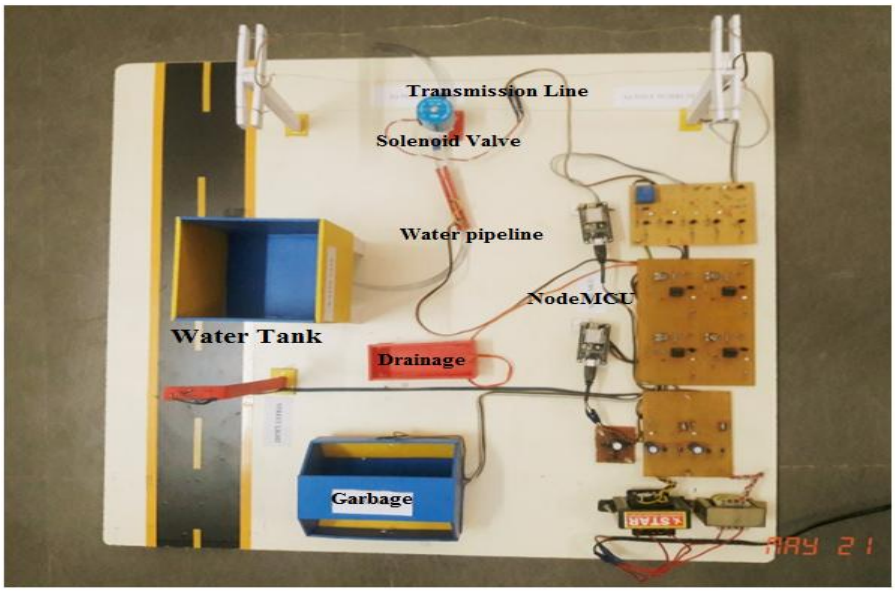

Fig. 2 Prototype model of proposed system.

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).

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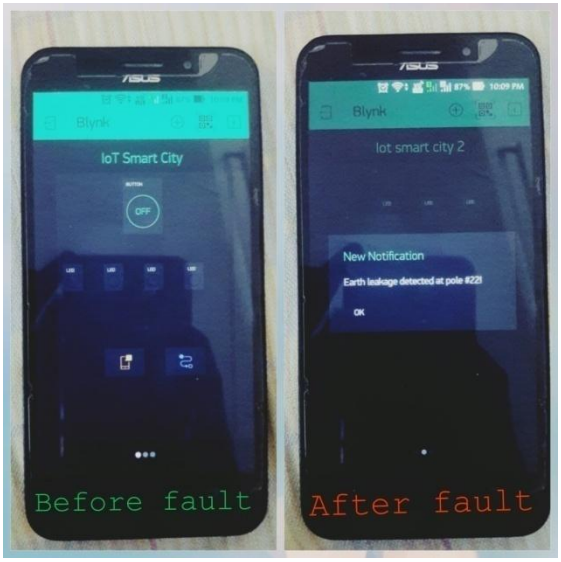

Fig. 3 Control and monitoring in an authenticated device.

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.

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.

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VI. ADVANTAGES & DISADVANTAGES

Advantages

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

Disadvantages

- Heavy investment.
- Maintenance cost is high.
- Needs internet every time.

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Applications

- Garbage overflow indication.
- Electrical fault clearance.
- Water pipeline breakage detection.
- Water supply automation.
- 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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