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IoT Based Smart City Control

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Abstract:

This paper presents technique based on an Internet of Things (IoT) based solar-powered smart waste management system, water supply automation, air quality monitoring, and electric fault clearance that can be used to any type of city or town in developed and developing countries. As a result of technological advancements, smart cities are now regarded as a flexible parameter that can be used to control, monitor, and operate in various fields (such as electrical fault detection, corporation duties, etc.) effectively without requiring a lot of time or labor, thus making the city smarter than it was previously. Urban areas can be connected to the Internet of Things (IoT), which has numerous uses in transforming a city into a "smart city." An earnest attempt has been made in this work to enumerate the components of "Smart Cities" and to address the problems that traditional cities face. Additionally, this paper's primary goal is to present a thorough analysis of smart city concepts and their various applications.

Key Words: *IoT*

I. INTRODUCTION

The arrival of technology and the capacity for remote monitoring and control has drawn the attention of scholars in recent decades. The concept of the Internet of Things, or IoT, is being established in large part by these needs. IoT has made it possible to implement numerous smart city applications, and there are numerous commercial and academic projects goods intended for these kinds of uses. Numerous attempts to use "Smart Objects" for environment and traffic monitoring are documented in the literature.

With the help of IoT technique, it is possible to remotely access anything (such as sensors, actuators, etc.), anywhere, at any time, and without the need for labor, all while giving city residents facilities. The fact that actions are not completed on time and there is far too much neglect is a prevalent feature of current techniques.

Many developed and developing nations have identified a number of shortcomings in the current technology and methods utilized for waste management and other issues related to smart cities.

For this system, we suggested a novel structure in order to accomplish this goal. In order to provide a clean, healthy, and environmentally friendly atmosphere in our immediate surrounds, the above Internet of Things (IoT) based solar-powered system can be an effective, economical, and clever option for proper waste collection, water level indication, air quality monitoring, humidity, and temperature monitoring.

II. OBJECTIVES

1. To provide continuous power supply to the equipment’s.

2. To make the technology environment friendly.
3. To increase energy efficiency and reduce waste.

III. DETAILS OF THE PROBLEM

We have seen that in many cities, irregularities such as garbage overflow, drainage overflow, water pipeline breakage, problem with the water supply and electrical problems such as over current and over voltage are not properly and promptly addressed. One potential fix to reduce these problems is IoT.

IV. DESIGN & DEVELOPMENT

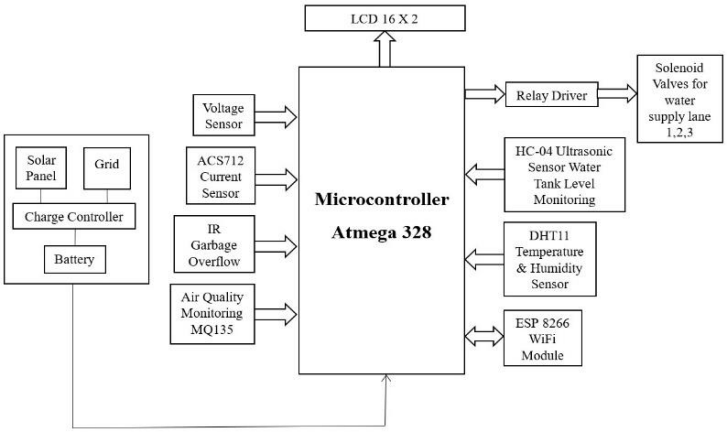

Fig.1: System block diagram

V. DETAILS OF COMPONENTS

1. **Solar Panel:** Light energy from the sun is absorbed by a semiconductor material on a solar panel. This absorbed energy causes the electrons to be freed, which results in the production of external DC current. In short, a solar cell is a type of photovoltaic device that produces electrical energy from light energy derived from the sun. Here we used solar system to provide continuous power supply to the system.
2. **Charge Controller:** Making sure the battery is not overcharged is the charge controller's job. Numerous manufacturers produce a vast assortment of commercial devices with current ratings ranging from a few amps to hundreds of amps and operating voltages typically in multiples of 12 V to 48 V (nominal battery voltage).
3. **Battery:** The best batteries for storing solar energy at home are lithium-ion ones. They can store more energy in smaller areas because they have a higher energy density. Compared to lead-acid solutions, they are more efficient and have longer lifespans. Many controllers will incorporate control algorithms that enable various battery types to be accommodated by varied control systems and/or settings. Although alternative battery types may be more cost-effective, lithium-ion batteries are typically the best choice for a solar panel system.

4. **Microcontroller:** This microcontroller is the heart of the system. The ATmega328 is a widely used micro-controller that is inexpensive, simple, and low-powered, and is utilized in many autonomous systems and projects. This chip is most frequently implemented on the widely used Arduino programming platform, specifically on the Arduino Uno, Arduino Pro Mini, and Arduino Nano versions.
5. **LCD 16×2:** A 16x2 LCD display is an extremely basic module that is frequently seen in many different kinds of circuits and devices. An LCD that measures 16×2 may show up to 16 characters on each of its two lines. Every character on this LCD is shown as a 5x7 pixel matrix. 224 distinct characters and symbols can be displayed on the 16x2 intelligent alphanumeric dot matrix display. LCD 16×2 is used to show all the applications on this display.
6. **Voltage Sensor:** A voltage sensor is a voltage measurement instrument. Voltage sensors have multiple uses for sensing voltage, ranging from detecting low current levels to monitoring high voltages. Numerous applications, such as power systems and industrial controls, depend on these devices. A sensor's voltage output can range from 5 to 10 volts, -5 to +5 volts, and beyond. Sensors with a voltage output are calibrated within this range using different engineering units, e.g., to ensure that the output value matches a particular pressure, temperature, load, tilt, etc. value.
7. **Current Sensor:** The ACS712 Current Sensor is a sensor that can be used to compute and measure the current flowing through a conductor without compromising the system's functionality. An integrated linear sensor integrated circuit (IC) based on the Hall effect is the ACS712 Current Sensor. Among these is the Current Sense Monitor. It converts a high side voltage into a proportionate output current. It operates between 20 and 2.5 volts. Products with portable batteries are made with it.
8. **IR Sensor:** In the case of "Garbage Overfill", here a light dependent 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.
9. **Air Quality Sensor:** Here the MQ 135 sensor is used to detect vapors, smoke, benzene, and other dangerous substances. It is able to identify certain dangerous gasses. It is useful for a variety of tasks, including monitoring air quality, detecting harmful gases, detecting air pollution in homes and businesses, and detecting air pollution on portable devices. In order to take actions that improve people's performance and health, this helps to determine the quality of the air in our facility.
10. **Relay Driver:** An output from a microprocessor is very low in a low power circuit. A relay (electromagnet switch) is required to drive a high load, and a relay driver is required to supply the correct voltage or current to a relay. An LED will light up just fine without one. Relay drivers are utilized at the site to transmit voltage alarms to a user-provided communications device.
11. **Temperature and Humidity Sensor:** Digital temperature and humidity sensor DHT11 is a simple, incredibly cheap device. No analog input ports are required; instead, it measures the ambient air using a

thermistor and a capacitive humidity sensor before emitting a digital signal on the data pin. Although it's quite easy to use, careful time to collect information.

12. **Ultrasonic Sensor:** An ultrasonic sensor is a device that uses ultrasonic sound waves to calculate an object's distance from it. An ultrasonic sensor relays information about an object's proximity by sending and receiving ultrasonic pulses through a transducer. Here we used this sensor for water level monitoring.
13. **Wi-Fi Module:** The ESP8266 WIFI Module is a self-contained SOC with integrated TCP/IP protocol. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking, functions from another application processor.
14. **Solenoid Valves:** 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. SYSTEM DESCRIPTION

Fig.1shows the actual block dig. of IoT Based Smart City Control. 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. And instead of this we can also use solar system to give the continuous supply this smart city. Now considering the case of “Garbage Overfill”, here a light dependent 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. Voltage sensor is used to measure the overvoltage and under voltage. Microcontroller detects how much voltage is their if there is over voltage it switches off the light connection and it switches off the main lines at over voltage at and under voltage. And it is same to the current when current flow through the certain limit. If switch automatic off then ACS712 current sensor is defined proper current or over current. If over current in system after the blast transformer so used ACS712 current sensor it protects the system from over current and switch off the lines supply. Air Quality monitoring sensor i.e. MQ135 sense all the gases in the atmosphere and measure air quality index. If air quality index is bad or good it gives the indication. And on the basis of it we have to control the quality of air. DHT11 is used to check temperature and humidity in weather and it gives us indicator. The value of how much temperature is there it shows on the display. ESP8266 Wi-Fi module it gives the internet connection of microcontroller. 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. LCD 16×2 is used to show all these applications on this display.

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VII. HARDWARE IMPLEMENTATION

Fig. 2: Demo Model

Fig. 3: Display Status of Humidity, Temperature and Garbage

VIII. GRAPHICAL REPRESENTATION:

Fig. 4: Temperature & Current Representation

Fig. 5: Air Quality Index & Humidity Representation

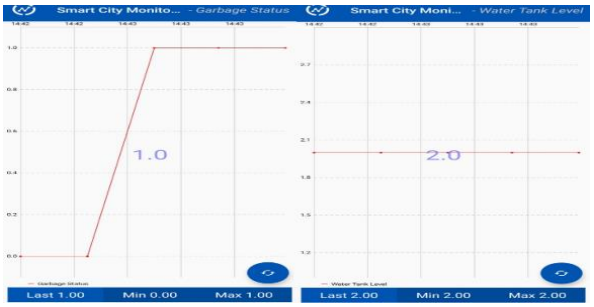

Fig. 6: Garbage Status & Water Tank Level Representation

IX. BENEFITS OF THE SYSTEM

1. Decrease in man powers.
2. Decrease maintenance expenses.
3. Wireless service
4. Accuracy

X. APPLICATIONS

1. Garbage overflow detection
2. Water supply automation
3. Electric fault clearance
4. Air quality monitoring
5. Temperature and humidity monitoring

XI. CONCLUSION

The concept of "IoT Based Smart City Control" reduce human costs, they also come with a significant reduce investment cost when adopted in cities. The fact that our proposal will make the cities atmosphere more orderly, disciplined, responsive and environmentally friendly should also be acknowledged. A working internet connection is necessary, though. Everything else will be accessible with just a few clicks. We promote "Make in India" and "Swachh Bharat" through our project as well or all right.

XII. FUTURE SCOPE

The future goals of the project include improving the efficiency and effectiveness of the system through additional optimizations and improvements. We investigate more sophisticated battery technologies, such as lithium-ion batteries which offer longer lifespans and a better energy density, longevity. Investigating alternatives to solar panels for the integration of renewable energy sources, such as hydropower and wind can possibly be included in future scope.

The options are infinite and there will be much more as technology develops, chances to develop and enhance the solar panel battery system.

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