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Internet of Things (IOT) and Smart City- Sustainable Development of Cities through IOT

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Abstract

Smart City projects and initiatives are made possible by the extensive IoT deployment. In order to make everyday items networked and connected to the Internet, they are being fitted with electrical devices and protocol suites. This main goal of this work is to integrate IoT technology into current infrastructure in order to address major issues that cities confront, such as traffic congestion, energy consumption, smart agriculture, smart homes, and public safety. The suggested Smart City solution allows for the collecting of real-time data by connecting numerous devices, sensors, and systems. The usage of technology like the Internet of Things, which gave rise to the idea of smart cities, has been made possible by the rapid development of the population and industrialization. India, a developing nation, has a lot of potential for creating technology that would make cities smarter. The need for resources and effective services will rise as urbanization takes place. IoT-enabled devices could be utilized to accomplish this in a clever and effective manner. This study has explored the potential design of an IoT system based on surveys done on comparable smart systems established. Also, the main purpose of this system is to make daily tasks easy and more efficient and it helps to reduce manpower.

Keywords: Internet of Things (IOT), Smart city, Sensor, energy consumption, traffic congestion.

I. Introduction

A smart city is an innovative idea that attempts to revolutionize urban environments through the integration of technology, data, and networking to improve the quality of life for its citizens and support sustainable growth. It makes use of the potential of cutting-edge

technologies like the Internet of Things (IoT), data analytics, artificial intelligence (AI), and cloud computing to build a linked ecosystem that optimizes resource utilization, enhances service delivery, and promotes innovation.

IoT refers to a network of physical devices, vehicles, buildings, and other objects embedded with sensors, software, and connectivity that enable them to collect and exchange data over the internet. These devices can interact with each other and with centralized systems to perform various tasks and provide valuable insights. IoTtechnology allows objects to become "smart" by making data-driven decisions and automating processes. Smart City uses digital technologies, including IoT, to enhance the quality of life for its residents and optimize city operations. Smart Cities leverage data and technology to improve infrastructure, public services, transportation, healthcare, energy management, and more.

Due to the rapid growth of Internet of Things (IoT) technology and the need for sustainable urban development, the idea of a "Smart City" has attracted a lot of interest in recent years. A smart city combines several digital technologies and Internet of Things (IoT) devices into urban infrastructure to improve the quality of life for its citizens, allocate resources more effectively, and increase the effectiveness of public services. The aim of the work is to create a seamless network of interconnected systems, sensors, and devices for data collection and sharing. Information can be acquired on a variety of topics, including traffic patterns, renewable energy, smart agriculture, smart homes, and public safety by putting a wide variety of sensors across the city.

The paper is organized in 5 sections as follows, section 1 contains the Introduction, section 2 is the Literature Review of the latest research studies performed, section 3 deals with the Methodology. The section 4 involves Working Principal of the proposed model and Section 5 presents the Conclusion and Future Scope.

I. Literature Survey

M. Aazam et. al in the paper [1] presents an extensive survey of IoT technologies and their applications in smart cities. It covers IoT architectures, communication protocols, security issues, and showcases examples of IoT- enabled services in urban environments.

S. A. Zeadally et. al in the paper [2] focuses on the use of IoT for traffic monitoring and management in smart cities. It discusses various IoT-based systems, such as intelligent transportation.

S. A. Khan et. al in the paper [3] emphasizes on the technologies, challenges, and opportunities associated with IoT in smart cities. It covers IoT architectures, communication protocols, security concerns, and potential applications in different sectors.

M. Z. Shafiq et. al in the paper [4] provides an overview of IoT technologies and their applications in smart cities. It discusses the integration of IoT with different urban domains, such as transportation, healthcare, and energy, highlighting the benefits and challenges.

According to study from Goldman Sachs Equity study group [6] 2014, IoT will have an impact on everyone's personal lives, workplace productivity, and purchasing habits. According to the research team, there were one billion internet users worldwide in the 1990s. By the year 2000, there were two billion mobile users worldwide. By 2020, the IoT has the ability to link up close to 28 billion "things.

II. Methodology

Our proposed system is consisting of ESP32 controller, IR sensors, Ultrasonic sensor, LDR, LEDs. ESP32 has inbuilt WIFI module and Bluetooth. The output of sensors is given to the ESP32 controller as an input. As Controller get sensors data it processes on it and send the data to the cloud.

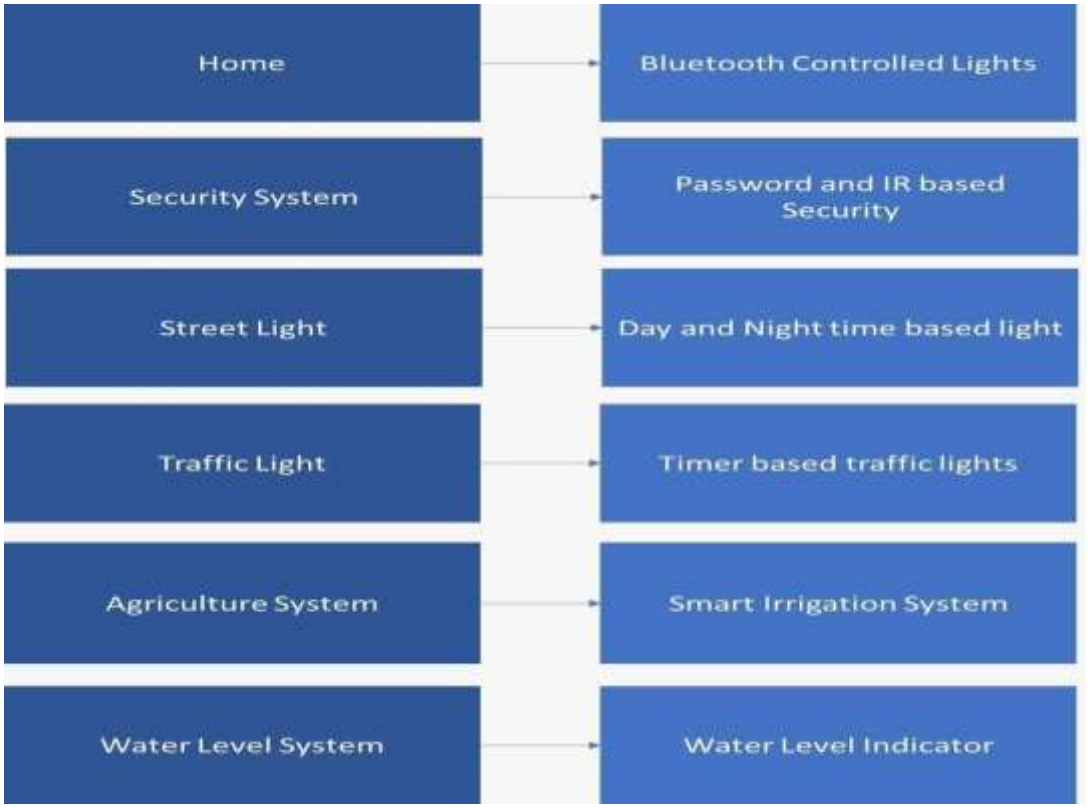

Figure 1: Flowchart of working model

III. Working Principal

The system architecture consists six model like Smart Light and Home, Automatic Street Light, Security System based on Password, Smart Irrigation System, Water Level Management System and Traffic Light with Automatic Timer.

i. Smart Light and Home:

Smart lights and home automation are part of the growing field of Internet of Things (IoT) technology. These devices are designed to make your home more efficient, convenient, and energy-saving by allowing you to control various aspects of your home remotely through smart-phones, voice assistants, or automation rules.

Home Automation:

IoT makes it possible to automate a variety of household equipment and systems, including lighting, HVAC, security, appliances, and entertainment systems. Remote control of smart home appliances is possible with IoT- connected devices like voice assistants or smartphones.

Energy Management:

Smart home systems built on the Internet of Things can track and manage energy use. Smart meters that are linked to the IoT network provide real-time energy usage data, enabling homeowners to monitor and effectively manage their energy usage. Homeowners can maximize energy efficiency and lessen their influence on the environment by integrating with renewable energy sources like solar panels.

Remote Monitoring and Control:

Smart houses that are IoT-connected enable homeowners to remotely monitor and manage a variety of features of their properties. For instance, customers can use their smartphones or other IoT devices to change the thermostat, turn on or off the lights, or see security camera feeds. This provides comfort and assurance, especially when homeowners are not home.

i. Automatic Street Light:

Automatic street lights, also known as smart street lights, are a modern lighting system that utilizes technology and sensors to automatically control the illumination of street lights based on certain conditions. These systems are designed to improve energy efficiency, reduce costs, and enhance public safety. Here's an overview of how automatic street lights work:

Adaptive Lighting and Dimming:

IoT-based street lighting systems have the ability to dynamically change lighting settings based on occupancy and ambient circumstances. Street lights are automatically dimmed or brightened in response to activity or changes in ambient light levels detected by sensors like

motion detectors or ambient light sensors. This method of adaptive lighting not only conserves electricity but also enhances security and lessens light pollution.

Energy Efficiency and Cost Savings:

By maximizing energy use, IoT makes it possible for energy-efficient street lighting. Based on traffic patterns, the time of day, or particular requirements, smart lighting systems can automatically change the intensity of individual street lights or groups of lights. As a result, the city saves a lot of energy and has lower operating expenses.

ii. Security System Based on Password:

A security system based on a password is one of the most common and fundamental methods used to protect digital assets, accounts, and devices from unauthorized access. It involves requiring users to enter a specific combination of characters (the password) before granting them access to a system or resource.

Access Control and Authentication

IoT-enabled access control systems, such as smart cards, biometrics, or facial recognition, enhance security in public buildings, transportation hubs, and critical infrastructure. These systems ensure that only authorized individuals can access restricted areas, reducing the risk of unauthorized entry and enhancing overall security.

Citizen Safety and Personal Security

People can report incidents, get help, or get real-time safety alerts thanks to IoT technologies like wearables and mobile apps. With the use of these systems, citizens can actively contribute to guaranteeing their own safety and security.

Emergency Response

IoT devices and cutting-edge analytics enable coordinated and quick emergency responses. To lessen the effects of calamities, integrated systems can instantly notify emergency services, offer real-time information on incidentsites, and optimise resource allocation.

i. Smart Irrigation System:

A smart irrigation system is an automated and intelligent watering system designed to optimize water usage and ensure efficient irrigation practices in agriculture, landscaping, and gardening. The system uses various technologies, such as sensors, weather data, and IoT (Internet of Things) devices, to monitor and manage irrigation activities effectively. The primary goals of a smart irrigation system include conserving water, reducing water wastage, and promoting healthier plant growth.

Automated Irrigation:

Sensors in IoT-based irrigation systems assess the amount of soil moisture, and weather information is used to calculate the best watering schedules. Automated irrigation ensures that crops get the proper amount of water at the right time, prevents overwatering or under-watering, and helps conserve water.

ii. Water Level Management System:

A Water Level Management System is a set of tools, techniques, and practices used to monitor, control, and manage water levels in various environments, such as rivers, lakes, reservoirs, or other water bodies. The primary goal of such a system is to ensure efficient and sustainable water resource management by maintaining optimal water levels for various purposes, including flood control, water supply, irrigation, hydropower generation, navigation, and environmental conservation.

Water Level Monitoring:

In order to continuously monitor water levels, IoT-based water level sensors are installed in rivers, reservoirs, and water storage tanks. These sensors, which provide real-time information on the water level, can be ultrasonic, pressure-based, or float switches.

Real-Time Data Collection:

The IoT platform or network that the water level sensors are attached to gathers and sends data to a central server or cloud-based system. This makes it possible to track and evaluate water levels in real time.

Remote Access and Control:

Through web-based dashboards or mobile applications, Smart City IoT offers remote access to the water level data. The ability to monitor the water levels from any location allows for proactive decision-making and prompt interventions by the authorities and stakeholders.

Alerts and Notifications:

When water levels exceed certain thresholds, the IoT system can be set up to automatically transmit alerts and messages to concerned parties, such water management authorities or emergency response teams. This makes it possible to take quick action to reduce the dangers of flooding or water scarcity.

i. Traffic Light with Automatic Timer:

A Traffic Light with Automatic Timer is a type of traffic signal system designed to control the flow of vehicular and pedestrian traffic at intersections or road crossings. It combines the traditional traffic light setup with an automated timer to regulate the duration of each signal phase.

Pedestrian Safety and Efficiency:

To identify pedestrians, IoT sensors can be incorporated into crosswalks and sidewalks. The technology has the ability to change signal timings to provide pedestrians enough time to cross safely. Push-button sensors used by pedestrians can also be linked to IoT systems to signal the activation of crosswalks.

Communication and Connectivity:

Traffic lights with IoT capabilities can be networked together to enable real-time coordination and communication. This enables traffic lights to communicate, synchronize signal timing changes, and respond to shifting traffic circumstances all at once.

Figure 2: Proposed Model

IV. Conclusion and Future Scope

We have successfully implemented the smart city model using IoT. A smart city as any IoT system uses smart equipment. The system modules are working efficiency and are able to send sensor data to remote user and user can control and monitor the data in order to keep city clean and rebuts. This system provides economic development opportunities with low power consumption and real database monitoring system based on IoT technology. The smart city systems uplift the human living standard and also given pleasurable environment.

In the future, we will use an Android application to monitor the data and also work for Emergency Vehicle Pre-emption.

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