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Survey and Implementation of IoT Based Smart City Towards Sustainable Urban Mobility

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***Abstract*: With the advent in the sensor and Arduino technology. Internet of things (IoT) conceptualizes the idea of remotely connecting and monitoring real world objects (things) through the internet. This project focuses on design and development of IoT based smart city with advance features such as Air quality monitoring system, smart solar street light smart sewage management.**

***Keywords*: Internet of Things (IoT), smart city, sensors, Arduino, suitability, energy efficient, management, system, challenges, services, infrastructure, quality of life.**

1. Introduction

IoT (Internet of Things) is revolutionizing the way we live, work and interact with the world around us. One of the key areas where IoT is making significant progress is in the development of smart cities. Smart cities are urban areas that use IoT technologies to enhance the quality of life for their citizens by improving their infrastructure, reducing energy consumption, and providing more efficient and effective public services. Here we will explore the benefits and challenges of implementing IoT-based smart cities. The project further divided into three modules they are air quality monitoring, smart solar street light and smart sewage water management.

In first phase of IOT based smart city the discussion is about air quality monitoring which displays the data on a LED Screen the air quality in high population areas and industrial areas has become vital. Mainly for homes who have kids and old age people the need to monitor the air quality indoors as well as outdoors with the help Arduino and few sensors to get the data regarding the quality of air.

2. Literature Survey

A lot of work has been carried out and is still going out and is still going on towards the implementation of smart cities there is a rapid advancement in technologies relating to the smart city projects. Some of the research works are given below

Paper [1] works with IoT to measure the concentration of gas using various sensors which were observed through serial monitor of Arduino. This data is collected channels by means of Ethernet shield. These analyzed results were viewed through thing speak in a graphical format. The average pollution level was calculated using MATLAB analysis and the time-controlled results were viewed through an android app. Further based on the location, the air quality index value was obtained through the android app. Along with this, the health effects were also displayed in this app, so that the users can stay aware of the pollution levels.

In paper [2], an efficient energy management frame work to provide satisfactory QOI experience in IoT sensory environments is studied. Contrary to past efforts, it is transparent and compatible to lower protocols in use, and preserving energy-efficiency in the long run without sacrificing any attained QOI levels. Specifically, the new concept of QOI-aware "sensor-to-task relevancy" to explicitly consider the sensing capabilities offered by a sensor to the IOT sensory environments, and QOI requirements required by a task. A novel concept of the "critical covering set" of any given task in selecting the sensors to service a task over time. Energy management decision is made dynamically at runtime, as the optimum for long-term traffic statistics under the constraint of the service delay. Finally, an extensive case study based on utilizing the sensor networks to perform water level monitoring is given to demonstrate the ideas and algorithms proposed in this paper, and a simulation is made to show the performance of the proposed algorithms.

The paper [3] has proposed dynamic light control solutions that permits an energy saving of more than 500/0 compared to classical static, time-based street light. The pro- posed system makes use of weather and human activity sensors for the implementation of the Dynamic Street light system. In this paper they have relied on two categories of indicators which are dimmed relevant to dynamic street light control.

Paper [4] has a simple proposed system on an Architecture of an IoT based middle ware for smart city which will act as a communication layer between the heterogeneous systems in the city, giving the authorities control over the infrastructure and data. This architecture will help the authorities operate more efficiently in a vendor agnostic environment and will motivate them to implement innovative business models which will lead to autonomous self-driven cities. This IoT middle ware system consists of a messaging system, a queuing and a routing system

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which can route data to any analysis platform. One of the major advantages for going for all IoT systems in a smart city is that the hardware utilization for communication will be maximized and the capex & opex cost will be minimized, compared to multiple end-to-end systems.

Paper [5] this paper presents the burst detection and localization scheme that combines lightweight compression and anomaly detection with graph topology analytics for water distribution networks. We show that our approach not only significantly reduces the amount of communications between sensor devices and the back end servers, but also can effectively localize water burst events by using the difference in the arrival times of the vibration variations detected at sensor locations. Our results can save up to 90% communications compared with traditional periodical reporting situations.

3. Problem Statement

As a lot of work has been carried out and is still in progress in order to build a smart city to overcome challenges. from the above papers it is been noticed that a lot of technologies which is been used is limited to a small range and hence therefore by using new and advanced technologies the range and the efficiency can be improved.

4. Objectives

The main objective of our project are:

- To design and develop a smart solar street light using solar panel and LDR which will be more energy efficient.
- To design and develop an air quality indicator which provides required information regarding the level of harmful gases.
- To design and develop a smear sewage management system.

5. Proposed Model

The smart city is divided into model it consists of mainly three parts

- The air quality monitoring system is used to monitor the quality of air in the environment which uses certain new technologies in order to increase the range of the system.
- The smart solar street light system consists of solar panel and LDR which is more efficient and consumes less energy.
- In smart sewage management the concentrating is on distribution of purified sewage water based on its PH level and therefore the water can be reused depending upon its PH levels.

A. Air Quality Monitoring System

The proposed air quality monitoring allows us to monitor and check live air quality as well as in an area through IoT. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. The sensors interact with Arduino uno which processes this data and transmits it over the application. This allows authorities to monitor air pollution in different areas and act against it.

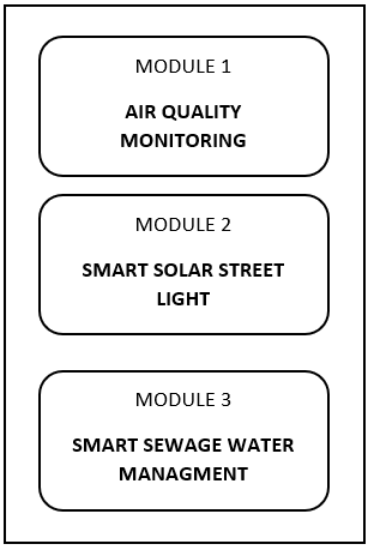

Fig. 1. Block diagram

6. Working Methodology

We start with connecting the ESP8266 with the Arduino.ESP8266 Wi-Fi module gives your projects access to Wi-Fi or internet. It is a very cheap device and makes your projects very powerful. It can communicate with any microcontroller and it is the most leading devices in the IOT platform. Then we will connect the MQ135 sensor with the Arduino. Connect a buzzer to the Arduino which will start to beep when the condition becomes true. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gases, so it is perfect gas sensor for our Air Quality Monitoring Project. When we will connect it to Arduino then it will sense the gases, and we will get the Pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and we need to convert it into PPM. When the value will be less than 1000 PPM, then the LCD and webpage will display “Fresh Air”. Whenever the value will increase 1000 PPM, then the buzzer will start beeping and the LCD “poor air”.

7. Conclusion

A lot of work related to smart city and its applications is been carried out and with advancement in technology the applications are been updated to newer versions which are more efficient and thus by using this knowledge the project focuses on implementation of smart cities and its application. In the first phase of project the module related to air quality monitoring system is designed and developed for implementation and further modules are designed and developed for implementation. The entire project focuses on implementation of smart city architecture with advanced features.

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