

An Intelligent Automated Street Light Controller and Lively Emission Control System

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Received: 09th July 2018, Accepted: 14th August 2018, Published: 31st August 2018

Abstract

An intelligent streetlight management system based on LED lamps, designed to facilitate its deployment in existing facilities. As street lights and traffic signals are crucial part of our day to day life this research focuses on two important aspects of this. First one is An Intelligent streetlight management system based on LED lamps which provides a smart and intelligent system for saving of nonrenewable sources of energy. Second important aspect implemented in this research work deals with the flow of traffic and the pollution levels at various places by monitoring the fundamentals of the air quality controls.

Keywords: Internet of Things, Air Quality Monitoring, Cloud Computing, Arduino Uno

Introduction

In this changing rapidly changing world automation has become a vital part for the growth of the economy and by the availability of new technologies it has added for reducing human efforts and maximizing the efficiency of the work.

As now a days new technologies are coming up and the needs of the people are changing rapidly, the automation in this world is leading to urbanization in various cities. Various cities are growing rapidly in and out to cater the needs. Due to urbanization it is leading to the exhaustion of nonrenewable sources of energy. So, to make the development sustainable, we need to make our cities smart by implementing new methods to curb the exploitation of our resources.

At the beginning, streetlights were controlled manually. After that, sodium vapour lamps came and some are still existing in almost all localities. The problem with these lights is the consuming power of these lights. Since the resources are declining each day, the problem has to be solved. So, the idea of shifting to LED streetlights which helps in saving up to 50% of our energy. Also by implementing smartly into the growing cities we can save even more energy by intelligent systems as implemented in our system.

By implementing Smoke sensor on a particular signal, the problem of pollution may be solved. The

value of smoke will be used for diverting the traffic from the previous signals.

More the vehicles, the more the emission of carbon monoxide, hence resulting into more pollution. As the level of smoke detector increases, LCD display will show that the people are supposed to change direction so as the pollution level will be controlled. Also data analysis will help the traffic control That is taking into account the values of smoke at various intervals of time, it is easy to conclude that at what particular time the traffic must be controlled so as the avoid pollution.

Literature Review

This section provides general survey on dynamic street light management and various emission control systems.

[1] This work deals with VehNode - a Wireless sensor network platform which deals with the vehicle pollution levels through the web of things (WOT). While dealing with the VehNode we got satisfying results of the pollution levels, but we can detect only few types of fumes. As of now the VehNode deals with only the pollution levels, we can make it generalized by new use cases in the future.

[2] A modern approach can be done by installing the new technologies in all the vehicles that pass through a particular path each day. This will help in reducing the time of a vehicle on a signal in case of heavy traffic congestion.

[3] The paper deals with the current issues of sustainability of resources and the technological changes coming forth. This model helps in i) reducing the consumption of energy on the streets by providing an intelligent and automated streetlight control system. ii) This also deals with catering to the criteria of smart cities which make the streetlights intelligent and also leads to sustainable development. Here we highlight the use of new types of streetlights which helps in minimizing the consumption levels and maximizes the sustainability. Similarly through small deployments (IoT), new methods and functions can come up which can form wireless network meshes. Going forward, we will further visualize the other aspects through various sensors and then analyze various

types of data to make it more smart and intelligent. This will further add to the other aspects and produce more data from sensors which in turn help in the development of this model. All this data can then be used by local bodies and government to take various actions and propose new projects for smart city implementation.

[4] This paper deals with functioning of the streetlights intelligently. This helps in minimizing the consumption of nonrenewable sources of energy and in turn makes our city smart. To replace the conventional halogen lamps with the power LEDs in the lighting system. This type of project is mainly appropriate in urban cities where most of the power is wasted in lighting up the street, when there is a minimum traffic flow during late nights.

[5] The main contribution of this work is based on big data and intelligent systems concepts for a traffic regulation system depending on the air quality data. Through this paper we have gathered various types of data based on the quality of air and the factors through which we can infer the congestion level of traffic. Here various types of data was gathered dynamically through the sensors and analysis was done on the think speak platform. The pollution level in the atmosphere plays a vital role in dealing with level of congestion in a particular area. The pollution level is then used in order to calculate the best route a user can use. Our dynamic results show that the data processing operations and the algorithms deployed in the large-scale data processing system are feasible and efficient. This approach has led to the conclusions of the peak time of the traffic in particular areas and hence in turn helped in curbing the problem of traffic congestion by alerting the users of the system to change their direction. This helps in reducing human efforts and time.

Proposed Work

An intelligent automated streetlight controller and lively emission control system is a combination of two systems mainly:

1. Automated Streetlight Control
2. Lively Emission Control System

1. Automated Streetlight Control

This system basically involved the streetlights and the intensity of light outside the system. A basic model was created using the LDR, IR SENSORS, LED lights.

- During day time due to high intensity of sunlight, the LDR i.e. light dependent resistors resistance decreases and hence the circuit is switched off and the LED lights are turned off. The whole system is in off mode during the day.

- During night time the intensity of the light decreases outside the system. This results in increasing the resistance of the LDR. This in turns results in switching on the circuit and the LED lights glow with low intensity (during the night).

- Following figure shows flowchart of working model

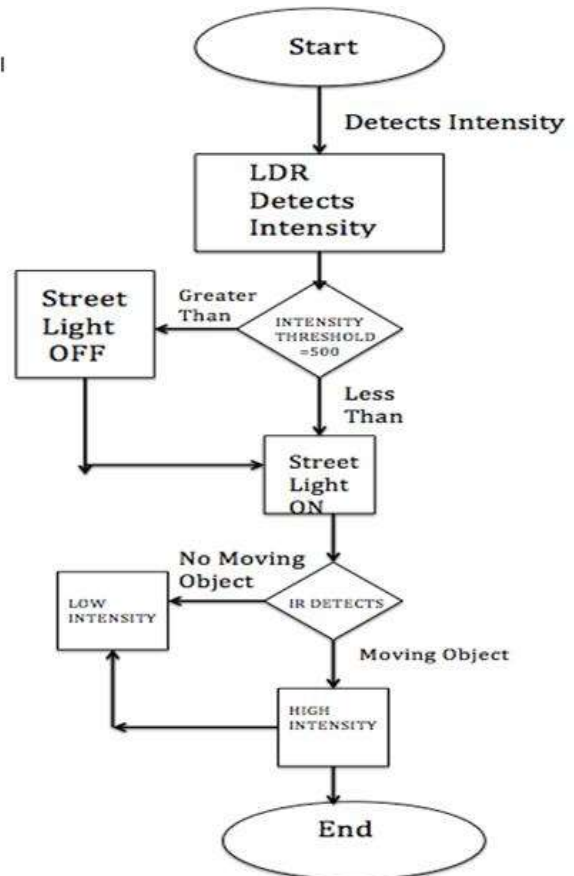


Figure 1: Flow Chart of Automated Streetlight Control

When a vehicle passes on the road, the IR sensors that are installed along with the streetlights start working. The IR sensors detect the vehicle and hence, the streetlights glow with full intensity for proper vision for the driver in the vehicle. The streetlights glow with full intensity unless and until the vehicle persist along the path, as soon as the vehicle passes the streetlight, the streetlight again glows with low intensity and comes to normal state. In this way, the automated streetlight control system helps in reducing the use of electrical energy.

2. Lively Emission control system

In this Emission Control System, MQ9 smoke sensor, LCD display, Things Speak Plat form was used. The smoke sensor detects the level of gas present in the atmosphere and was provided with a threshold (5000 ppm). Depending on the level of

smoke, the threshold value was set. Below the threshold value, the circuit was put on hold and the LCD displays “!!!!Hello!!!” on all the adjacent signals. Above the threshold value of the smoke sensor, the traffic signal is alerted with the sound of the buzzer and the LCD displays “Change Direction” in all the adjacent signals.

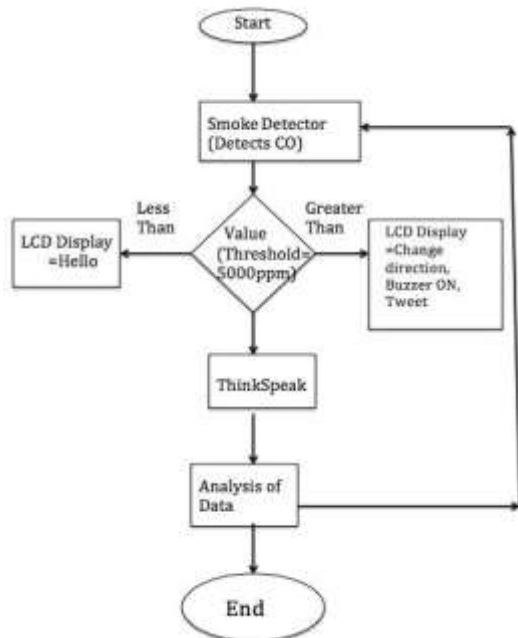


Figure 2: Flow Chart of Emission Control System

The analysis done helps in studying the level of gases in the atmosphere and the pollution levels dynamically. The dynamic analysis helps in providing the maximum and minimum values during the whole day. This helps in studying the traffic flow in that particular area at that particular time. As soon as the values cross the threshold, the users registered on the ThingSpeak platform receive tweets for the traffic congestion in that particular area. This helps in analysing the traffic flow depending on the level of pollution in that area. The traffic flow and congestion is directly proportional to the level of pollution in that area. A graph based on the pollution level in ppm and time was made dynamically in the ThingSpeak platform for analysis.

As in consideration of the project, the whole system was connected to ThingSpeak by its IP address which was embedded in the Arduino UNO sketch and fields was set to extract the values from smoke sensor and a graph was displaced of smoke sensor Vs time. Depending upon the threshold value, Tweets were send.



Figure 3: Graphical Representation of Smoke Values on ThingSpeak

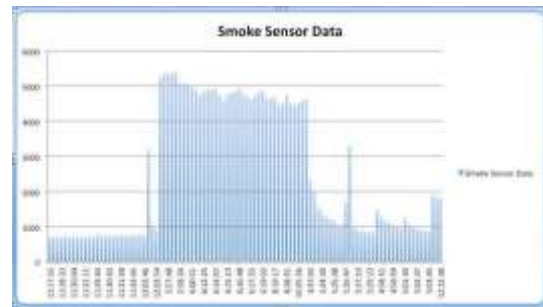


Figure 4: Bar Graph Representation of Smoke Sensor Data Vs Time

Empirical Results and Data Analyses

ThingSpeak platform is used to analyze data. It is an IoT based platform service that allows you to analyze the data and draw conclusions for our visualization of data.

Analysis in R

Regression model was created on the dependency between the smoke and the wind flow. The analysis was done in R, where the independent variable was wind flow and the dependent variable was smoke value. The regression resulted in slightly no dependency on the wind flow and the smoke. This was due to the continuous flow of traffic. Hence the emission control system helped in reducing traffic congestion as well as pollution level in various areas.

The whole smoke sensor data from ThingSpeak was taken into excel sheet and analysis was done in Microsoft Excel and R language software



Experimental results of the proposed system for light intensity controller are as follows:

Conclusion

The use of Internet of Things has allowed a wide range of applications regarding smart city implementations. This project will concentrate on two main aspects of smart city implementation. The first research effort taken in this project i.e. automated streetlight controller has significantly reduced the consumption of electricity. The street light system will help in regulating the smooth flow of traffic during the night time so as to avoid accidents due to absence of streetlights. Second is the emission control system that will allow us to regulate the traffic and also control pollution at the traffic signals.

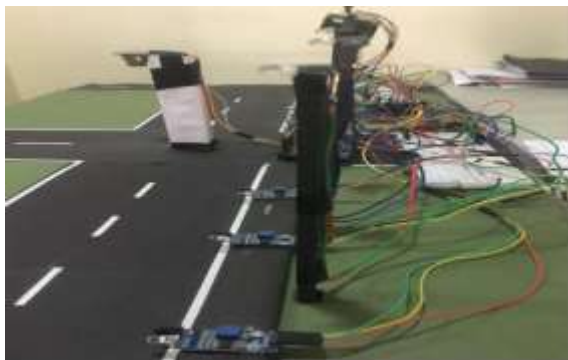


Figure 6: Streetlight OFF During Daytime



**Figure 7: Streetlight ON During Night Time
Flowing With Low Intensity**

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