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Traffic Signal Controlling using NodeMCU

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ABSTRACT—

Every town inside the international suffers from traffic congestion, which significantly disturbs the residents. This trouble is made worse with the aid of sign timing delays because present day visitors lights aren't traffic condition-adaptive. An growing quantity of human beings are in need of effective automatic traffic manipulate technology to deal with this. In this observe, a density-primarily based dynamic traffic signal control scheme is proposed. The gadget makes use of infrared sensors fixed on road poles and a Node MCU microcontroller to mechanically modify signal timing in step with site visitors density at intersections. It is important to go from fixed-time signaling to computerized decision-making. Current fixed-timing structures end up useless when imbalances in traffic flow rise up. This observe proposes a way to a common city hassle by way of introducing an adaptive visitors light device to lessen congestion. The growing numbers of the private vehicle motive the road site visitors congestion. That is becoming essential issues within the large cities. Another way to lessen the site visitors jam is growing clever transportation machine consisting of intelligent traffic mild device. However, the solution of such issues is one of the mandatory situation. In recent years, a smart metropolis is the hottest subject matter for the efficiency of site visitors mild using the Internet of Things. Based on that issue, this research proposed traffic mild monitoring machine which can reveal and show a real-time site visitors congestion through smartphones. The machine applied Node-MCU (ESP 8266 12E) prepared through IR impediment sensor to signify the road site visitors congestion. To join the internet, the system uses ESP8266 12E wifi inside the chip of Node-MCU. It will send a notification to smartphones consumer. With this research, it's miles anticipated to enhance street visitors fantastically inclusive of to expect visitors congestion and the device can supply some efficient routes for a person. Keywords: Traffic congestion, Dynamic site visitors signal manage, Automatic gadget, Node MCU, IR sensors.

Introduction

This undertaking affords a clever traffic sign manage machine the use of Node MCU (ESP8266), designed to reduce congestion by way of dynamically adjusting sign timings based on realtime site visitors situations. IR sensors detect vehicle presence, and the device makes use of the Blynk app for remote tracking and manage. It is a fee-powerful and efficient answer for contemporary city site visitors control. Human existence is greater precious than whatever else, well timed assistance is greater important than lending a assisting hand. This venture is one in every of those that is designed in a way to store human lives in a timely manner. The visitors device acts as a cornerstone to international's economic system. With the increasing price of population, the numbers of vehicles on roads are growing concurrently. This results in increase of charge of site visitors jams on day by day basis Congestion in traffic is a critical trouble. In present machine sign timings are constant and they may be independent of visitors density. Thus, we advise a new layout which mechanically communicates with the traffic alerts, and assist the ambulance to bypass thru the manner. The proposed machine is succesful to switch the visitors signal to blue, when the vehicle approaches the visitors signal. In this proposed, IOT based site visitors manipulate device is carried out in which sign timings are up to date based totally at the vehicle counting. Circuit breakers. The reason of a substation is to 'step down' high voltage electricity from the transmission device to decrease voltage energy so it can be easily furnished to homes and groups within the vicinity t/thru lower voltage distribution lines. Traffic sign manipulate is a critical part of city site visitors management. Traditional visitors lighting fixtures perform on fixed timers, which can cause useless delays and traffic congestion. To triumph over this, an automated traffic signal machine the use of Node MCU (ESP8266) can be evolved to beautify performance and flexibility. Node MCU is a lowcost, Wi-Fi-enabled microcontroller ideal for IoT initiatives. In this gadget, it is used to control the functioning of Red, Yellow, and Green LEDs representing traffic lighting fixtures. The lighting fixtures can be operated in a fixed-time mode or stronger using sensors like IR or ultrasonic to locate automobile presence and regulate signal timing hence. This makes the device greater attentive to actual-time visitors situations. The machine can also be linked to the internet to allow faraway tracking and manage the use of systems like Blynk or a custom internet server. This opens up possibilities for remote traffic control, integration with smart town systems, and prioritization of emergency Traffic Signal Controlling the use of 2 cars. The principal additives used in this venture consist of Node-MCU, LEDs, resistors, jumper wires, and optionally IR sensors or a mobile app interface. The system is programmed the usage of the Arduino IDE, making it available to college students and interest is This task demonstrates a sensible utility of embedded structures and IoT in fixing actual-global troubles. It is scalable, power-green, and an high-quality foundation for growing more superior wise traffic systems.

Literature survey

Real-Time Intelligent Traffic Light and Density Controller – A Literature Review Authors: N. Santhosh Kumar, Ankith Anthony Surendar, S. Harshith Prasad, V. Vishal, Sundari Tribhuvan amInt. J. Mod. Developments Published in: International Journal of Modern Developments in Engineering and Science, 2022 Int. J. Mod. Developments

Description:

n order to create a real-time intelligent traffic light system, this article investigates the integration of technologies such as LoRa, OpenCV, and NodeMCU. Periodically counting traffic and sending out alarms when big cars approach junctions are two features of the system's architecture. It can also use ALPR to recognize license plates for theft vehicle identification and send monitored data to distant control centers via the internet. Emergency response times are improved by the system's ability to switch signals to green when an ambulance is spotted thanks to the addition of LoRa transceivers. A number of interrelated systems make up the Indian city management system, which is crucial for traffic control. It is a crucial component of a smart city as well. Excessive vehicular traffic causes stressed and angry commuters to miss day to day activities, more usage of gasoline, damage of vehicles and life of travellers Furthermore, an increasing population directly contributes to an increase in traffic related factors such as over-speed, collisions, and many more. Smart traffic management has therefore developed as a mandatory necessity for a prosperous civilization. Intelligent and flexible traffic management systems are currently favoured over specified time schemes in most developed countries. This form of traffic management is primarily monitored by centralized systems/servers. In light of this, the IoT, which now has proven useful in almost every aspect of our everyday lives, can be viewed as a forum for central server traffic management. The number of cars going through a road a several distances before the currently active traffic jam locations can be transmitted to the existing traffic flow control centre. The timely data collected for the city's traffic jam nodes can be conveyed via internet and cloud to handle car entry. For real-time vehicle counting, image processing tools are used in OpenCV. The proposed work is cost effective with minimal infrastructure. The proposed framework for urban settings collects real-time video images, then separated into frames, and the count is measured using the suggested car counting technique after binary transformation, and noise reduction. The further image analysis and statistical interpretation of data can also be helpful in real-time traffic management. With population growth the number of vehicles has increased significantly over recent decades. In recent years the density of vehicles moving on roads is fast increasing leading to human life disturbances like enormous vehicle congestion, sound pollution, vehicle theft, accidents, etc. and hence effective traffic management control is very necessary.

An Exploring IoT Solution for Enhanced Smart Traffic Management System Authors: Akash Maji, Pragati MahaleMultiTech Publisher Published in: International Journal of Applied and Advanced Multidisciplinary Research MultiTech Publisher

Description:

This study delves into the application of IoT in enhancing smart traffic management systems. It discusses how IoT acts as a middle layer, facilitating communication between web-connected devices and traffic components like sensors and actuators. The paper emphasizes the role of IoT in reducing traffic congestion, optimizing flow, and ensuring safety, especially for the elderly. It also highlights challenges in implementing advanced machine learning and data-driven techniques within IoT frameworks for traffic management. Traffic management is the focus area for most urban dwellers and planners. Congestion is the most important major obstacle that has been seen in many countries including India. Countries To avoid this obstacle means how to manage the traffic smoothly. Traffic congestion mainly focuses on the signal’s failure, reduced law enforcement and improper traffic management. Existing foundation can’t be extended increasingly and subsequently the main choice accessible is to enhance the administration of the traffic. Traffic congestion is not a good sign for our country as well as it creates a negative impact starting from economy to the leaving standard. Consequently, the opportunity has already come and gone to viably deal with the traffic congestion. Many methods are designed to manage the traffic and minimize the congestion. Out of all the techniques, infrared sensor, inductive loop detection, video data analysis, wireless sensor network, etc. are used to somewhat solve the congestion in the traffic and to manage the traffic smartly. But in the above said methods having some demerits like much time to take for installation, maintenance cost is very high. Actually, our objective is to develop a new technology or method; that will solve the above problems and produce better result within a stipulated time. To overcome the challenges, a new method arises called as Radio Frequency Identification (RFID). By this innovation, it will require less time for establishment with lesser expenses when contrasted with different strategies for traffic blockage administration. Utilization of this new innovation will prompt lessened traffic jam. It refers to small electronic devices that consist of a small chip and an antenna. It plays a vital role in intelligent traffic management system technologies to sense the presence and movement of tagged objects; the traffic will be monitored and managed automatically using this system.

Smart Traffic Management Systems: A Comprehensive Review of Existing Solutions Authors: Siddhant Dawkhare, Amrish Jadhav, Yash Jariwala, Palak DesaiSTM Journals Published in: International Journal of Online and Innovative Research, 2024

Description:

This comprehensive review addresses the escalating challenges of traffic congestion due to the rapid increase in vehicle numbers. The authors discuss the societal impacts, including time wastage, health issues, pollution, and economic setbacks. They propose smart traffic management systems that consider both traffic flow and individual challenges, aiming to minimize time spent at signals, identify unoccupied spaces, and prevent traffic jams. The paper also explores the use of image processing technology to enhance traffic signal controllers' intelligence. The number of automobiles is quickly growing these days. This is one of the causes of traffic congestion because there are so many amenities accessible for public transportation these days, making it simple for people to use various modes of transportation. People have also grown accustomed to this, which is why there are more cars in large cities. It raises several detrimental issues for the environment and society, including consequences on public health and pollution caused by an increase in the number of automobiles. The growing number of vehicles on the road has made traffic congestion a serious issue. Reducing traffic congestion and making sure that traffic moves safely and smoothly is the major challenge. Recently, research has focused on using image processing technology to improve traffic problems and increase the intelligence of traffic signal controllers. It gets rid of restrictions from previous conventional traffic control systems.

Smart Unidirectional Road Lighting Control Using Node MCU ESP8266 Authors: Mouaad Yaichi, Mhamed Rebhi, Bouchiba Bousmaha Springer Link +1Research Gate +1 Published in: Artificial Intelligence and Renewables Towards an Energy Transition (ICAIRES 2020)SpringerLink

Description:

This paper presents a novel technique for developing street lighting systems aimed at reducing energy loss from traditional lighting setups. The proposed system uses NodeMCU ESP8266 and PIR sensors to collect information on road users, enabling the creation of lighting in the user's area and ahead. The system facilitates wireless communication between lighting units, ensuring optimal management of road users by providing necessary lighting, thereby enhancing energy efficiency and user security. The rapid development of cities has resulted in a significant expansion of the smart network. Street lighting is one of networks that has been greatly expanded, Nowadays, street lighting has become a great importance in people's lives because it ensures their safety during the night. The street lighting is one of the largest energy expenses for a city, accounting for upwards of 35- 45% of a municipality's utility budget [1]. In most areas, street lighting is controlled in two ways, the first method by manual operation, which is inflexible, inefficient and cumbersome of manpower. The second method, optical-control, which has solved the manpower problem but it is ineffective in reducing energy costs. The advanced technology has created smart lighting systems for the streets, which have helped to resolve control and management street lighting problems. and also, it has also taken into account these smart systems various aspects as security of users, and energy efficiency. At present, reducing energy costs is one of the biggest challenges' governments faces across the world. Energy savings are valued at the level of smart street lighting systems often by 25-60% [2] or between 30% and 50% [3], which represents a significant gain for the reduction of the state budget.

An IoT Application in a Smart Traffic Management System Author: Shailesh Shivajirao BhiseApplied Sciences Journal Published in: Journal for Research in Applied Sciences and Biotechnology, 2025Applied Sciences Journal

Description:

This research focuses on the implementation of IoT technology in smart traffic management systems to address the challenges posed by rapid urban development and increasing vehicle numbers. The paper discusses how IoT facilitates real-time traffic monitoring and modification, optimizing transportation patterns, reducing delays, and enhancing road safety. It also examines various IoT architectures, communication protocols, data analytics principles, and actual implementations, while addressing security threats, scalability, and infrastructure expenditure concerns. Urban regions now face escalating traffic issues because of their escalating vehicle traffic which produces congestion while raising pollution measures and creating multiple accidents. Urban growth together with increasing population numbers created these problems so smarter traffic management methods became essential. Current manual controlled traffic management systems together with pre-established fixed timing signals fail to react to real-time traffic conditions which results in system inefficiencies. The implementation of IoT technology as part of smart traffic management helps sort out driving risks along with congested roads and it optimizes roadways by analysing and recording real-time data. The combination of sensors with communication networks together with artificial intelligence through IoT creates dynamic decision systems which enhance city traveling and decrease environmental effects from traffic. The examination of IoT applications in traffic management is the target of this review while it presents detailed findings about existing progress and future research directions which demonstrates both positive possibilities and obstacles to implementation.

Methodology

- System Analysis & Requirements: Identify the monitoring wishes (e.G., voltage, modern-day, temperature) and desires (actual-time facts, fault detection, predictive protection) through consulting with MSEB engineers.
- System Architecture Design: Plan the system components (sensors, RTUs, SCADA, verbal exchange protocols), and integrate predictive upkeep using AI/ML.
- Hardware & Software Selection: Choose reliable sensors, RTUs, and conversation devices. Develop or configure SCADA software program and cellular/internet interfaces for actual-time monitoring.
- System Integration: Integrate all components for seamless records collection, transmission, and analysis.
- Testing & Validation: Conduct functional, overall performance, and redundancy exams to ensure reliability and accuracy, together with AI-primarily based predictive maintenance validation.
- Pilot Deployment: Implement the system in a constrained wide variety of substations, acquire feedback, and train operators.
- Full-Scale Deployment: Roll out the gadget to all substations, ensuring complete integration and scalability.
- Continuous Monitoring & Optimization: Monitor machine overall performance, replace predictive algorithms, and optimize based totally on feedback.
- Post-Deployment Support & Training: Provide ongoing help and training to operators and make certain device updates and enhancements.

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