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An Iot Based Dynamic Road Traffic Control System for Bangladesh Using Image Processing

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Abstract

Traffic management has become one of the biggest problems due to the increase in vehicles. A manual system of traffic control is not effective for the present traffic jam situation [1]. A traffic management system utilizing the Internet of Things (IoT) and Image Processing techniques are presented in the paper. Real-time data can be analyzed using image processing in the proposed system [5][9]. Using multiple camera lanes are monitored continuously with different lanes. Analyze the obtained data from the different lanes. Using image processing, the number of vehicles in each lane can be detected and counted. Information about the count from each lane is passed to the central processing unit [6]. The algorithm determines the amount of time each lane might wait based on the number of vehicles, and then it determines the timing of the signal lights [11]. As a result, the average expectancy time is reduced, and the clearance of traffic is more efficient. Adaptive traffic management using the Internet of Things (IoT) also reduces pollution resulting from carbon dioxide (〖CO〗_2) emissions and can be helpful in emergency situations.

Keywords: *Internet of Things, IoT, Embedded Systems, Road Traffic Management, Adaptive traffic management system.*

INTRODUCTION

The Internet of things (IoT) represents a collection of smart technologies and connected devices that are very intelligent [1]. IoT can transfer data via the network without requiring human-to-human or

human-to-computer interaction. Internet of Things (loT) made our daily work more easy and smart. We have used loT in many areas like electricity, gas, water, vehicle, etc [2][3].

The research says that in the year 2020, 56.2% of world's total population resided in urban areas. The following years also have had the increase in urban population which has put constraint on transport system. As the cost of living in business areas is high the employees living far from work place have to travel from their place of living [8]. Though the making of roads bigger seems to be sudden response to the issue, cities must aim on running their roads smarter [9].

The combination of traffic systems with the IoT will assure the smart security along with the road safety. The building of embedded system by combining of many sensors with the concerned website which enables the access to real time information will result in the more effective and safe traffic control [7].

In Bangladesh, most of the people depend largely on-road transportation. At present road accident has become a major problem for Bangladesh, and the main cause of road accidents is high-speed driving. A fixed speed of the vehicle should be set on the highway roads of Bangladesh. By controlling the speed of the vehicle, it is possible to reduce the number of accidents [5].

Table 1: -Statistics of die people in road accidents

Year	Die People In Road Accidents
In 2021	6,284
In 2020	6,686
In 2019	7,855
In 2018	7,221
In 2017	4,284

The project by IoT controls and monitors vehicle speed correctly. While starting for the journey most of the vehicles have over speed. It is the main reason for a road accident [4]. We have developed a device that monitors the speed of vehicles. We have used smart cards/boards for every vehicle. Each smart cardboard has a specific number. The device sends a message nearest police control room for the over-speeding vehicles with the smart card/board number. At the same time, the device sends a message to the driver for hither over speed. All the devices can communicate internet, and that can be monitored and controlled [4][5][6][7].

OBJECTIVE

To develop IoT devices for monitoring and controlling vehicle speed and controlling traffic signals.

Background Study

Our country has recently faced a problem where road accidents are often occurring. Road accidents are responsible for thousands of deaths each year in Bangladesh [17]. Keeping in view of mortality, different devices have been made to reduce the mortality rate. Deadly accidents are exacerbated by unfit vehicle, unskilled driver, and over speed driving. Several systems have been proposed regarding this issue [21][27].

LITERATURE SURVEY

Currently, in Bangladesh, no vehicle speed monitoring device has been implemented. To address this problem, many different techniques have been devised.

The growth and improvement in internet with regard to bandwidth and speed, internet of things has been able to take the market on different platform and has made way for numerous inventions. IoT is enabled due to the contribution of fields like embedded systems, automation, wireless sensor network and control systems. Smart traffic control is possible by the interaction amongst the elements of transport system. And all the feature of transport systems has the employment of IoT. Platform of IoT facilitates continuous inspection of traffic through wireless sensors and it ensures to alert when exceptions in management happen [15].

In this paper we intend to design a system aimed at early detection and alert of dangerous vehicle driving patterns it was helpful parents because know days most of accident was caused by college student by over speed by installing our device in bike we can get the speed of the vehicle if the vehicle cross the speed limit, in our device we are using speed sensor to detect the vehicle speed and arduino to monitor the speed it will check the vehicle if the vehicle cross speed then it will intimate GSM board to send speed information to consulted authorities like parents or consulted person which we are specify by owner of the vehicle [13]. Researchers also used arduino and sensors, but this device sends messages to the nearest police control room for vehicles traveling at high speeds [18]. If the vehicle over speeding is found from the calculation, the speeding penalty will be charged or case against the owner of the vehicle.

Proposed the system does not need any human interception and records the car speed as well as informs the concerned authorities for the violations [4]. This paper aims at developing a system that will detect the speed of the vehicle, if over speeding occurs, extract the license plate number and send it immediately to the nearest concerned traffic authorities. The theme of this paper is vehicle license plate recognition system based on image processing in intelligent transport system. It uses Character Recognition Technology for extraction and accuracy analysis is done based on lightning conditions. It developed this proposed system based on IoT, and used smart card/board in this proposed system to detect over speed vehicle in Bangladesh (White, Green and Blue color card or board. I used Global Positioning System (GPS) for tracking vehicle location [14].

METHODOLOGY

The cloud contains all the information in the database which has information like users, vehicles, Traffic offences, Safe limit for each Road, Locations of each vehicles and roads etc. The network of these Vehicles is stored to identify and authorize and also track their features like conditions, driving range, max speed, safety measures etc. The officials are given premium benefits to monitor the vehicle registrations, available users, incoming applications, traffic violence and offence, and traffic flow [10]. These officials can access and modify the blockage of routes in case of a VIP patrol or any other unavoidable closures in the road and the users can choose an alternate route. The alert is used to notify all possible commutes near the blocked road and hence congestion can be avoided. Traffic offences- like riding without a helmet, speeding over the safe limit etc. can be captured through the devices which identify the number plate of the vehicle and the currently logged user is penalized based on the governance fines. Other traffic devices include signal lights, Digital Speed meter Boards etc [12]. These can be modified based on traffic status in the road under consideration or route under commute. A rerouting algorithm is crafted to deviates ambulance to low congestion position based on network of sensors and vehicles employed in the IOT module [25].

PROPOSED SYSTEM

This given system overcomes the flaws of previous traffic administered systems. The structure takes traffic solidity as input from cameras which is abstracted from Digital Image Processing technique and sensors data, resultantly giving output as

signal data, resultantly giving output as signals management [16].

An algorithm is given to predict the traffic solidity for future to minimize the traffic congestion. Development of IOT based traffic management system. Identify and penalize traffic violators and help officials identify unauthorized drivers. Reroute the ambulance to the low congestion roads to help get medical care at the earliest [28].

SOFTWARE REQUIREMENT

Matlab

MATLAB is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks. MATLAB supports matrix manipulations, plotting of functions, implementation of algorithms, creation of user interfaces, and allying with programs written in other languages. MATLAB is used in many technical fields for data analysis, problem solving, and for experimentation and algorithm development [17][19].

Implementation

The gateway is the GUI of the project which gives access to the individual objective codes in MATLAB. The GUI is designed based on the GUIDE library in the software tool. The various accessories from the GUI takes through the appropriate codes as mentioned [23].

Number Plate Detection

License Plate popularity is one of the strategies used for car identity purposes. The sole aim of this mission is to locate the maximum green manner to apprehend the registration records from the virtual photo (acquired from the camera). This method generally accommodates of 3rd steps. First step is the registration code localization, no matter the license-plate length and orientation. The 2nd step is the segmentation of the characters and ultimate step is the popularity of the characters from the registration code [31]. Thus, this mission uncovers the essential concept of numerous algorithms required to perform individual popularity from the registration code License Plate popularity is one of the strategies used for car identity purposes. The sole aim of this mission is to locate the maximum green manner to apprehend the registration records from the virtual photo (acquired from the camera). This method generally accommodates of 3rd steps. First step is the registration code localization, no matter the license-plate length and orientation. The 2nd step is the segmentation of the characters and ultimate step is the popularity of the characters from the registration code.

Thus, this mission uncovers the essential concept of numerous algorithms required to perform individual popularity from the registration code in the course of Template Matching. This function of the set of rules noted above helped in accomplishing quicker individual popularity of the registration code. This method of individual popularity includes steps like Image processing, Defragmentation, Resizing and Character localization which might be required to be done at the photo so as for Template Matching to be done. Tollbooths in Bangladesh usually appoint a simply visible gadget of car type. However, this reasons a massive lack of sales to the companies running the tollbooths because of rampant malpractices and discrepancies [20].

Step 1 Input Image

Step 2 Extraction of Number Plate Location

Step 3 Remove connected objects on border

Step 4 Character Segmentation

Step 5 Character recognition and display result

As nearly all the tollbooths appoint cameras for protection purposes, it changed into felt that the feasibility of a gadget the usage of IP cameras has to be tested. Violators may be diagnosed and penalized primarily based totally on quantity plate data. This method is simplified to segment all of the letters and numbers used within side the quantity plate with the aid of using the usage of bounding field method. After segmentation of numbers and characters gift on quantity plate, template matching method is used to popularity of numbers and characters. The listen is given to discover the quantity plate place nicely to phase all of the quantity and letters to perceive every quantity separately [33].

Image Pre-Processing: Image Cropping/Resizing

Images are resized because of number of reasons but one of them is very important in our project. Every digital digicam has its decision, so while a device is designed for a few digital digicam specs it'll now no longer run effectively for some other digital digicam relying on specification similarities [34]. So, it's far vital to make the decision regular for the software and as a result carry out photo resizing. Also, the photo is cropped in order that we paintings on our principal attention region in place of the complete frame. This relies upon at the digital digicam positioning i.e. the information set used [30].

Image Enhancement

Image enhancement is the system of changing virtual pictures so that the consequences are greater appropriate for show or in addition analysis. For example, we can take away noise, to make it greater less complicated to become aware of the important thing characteristics. In bad assessment pictures, the adjoining characters merge for the duration of finalization [22]. We need to lessen the unfolding of the characters earlier than making use of a threshold to the phrase photo. Hence, we introduce POWER-LAW TRANSFORMATION which will increase the assessment of the characters and facilitates higher segmentation. The fundamental shape of power-regulation transformation is in which r and s are the enter and output intensities, respectively; c and are high-quality constants. A type of gadget used for photo capture, printing, and showing reply in step with a power-regulation. By convention, the exponent withinside the power-regulation equation is called gamma. Hence, the system used to accurate those power-regulation reaction phenomena is referred to as gamma correction. Gamma correction is crucial if showing a photo correctly on a laptop display screen is of concern. In our experimentation, it varies withinside the variety of one to 5. If c isn't identical to 1, then the dynamic variety of the pixel values may be extensively tormented by scaling. Thus, to keep away from every other level of rescaling after power-regulation transformation, we restorative the fee of c = 1. With = 1, if the power-regulation converted photo is handed thru binarization, there may be no alternative withinside the result in comparison to easy binarization. When > 1, there may be an alternate withinside the histogram plot, when you consider that there's a growth of samples withinside the containers closer to the grey fee of zero. Gamma correction is crucial if showing a photo correctly on the laptop display screen is of concern [24].

Edge Detection

Edge detection is the call for a hard and fast of mathematical strategies which intention at figuring out factors in a virtual photo at which the photo brightness modifications sharply or, greater technically, has discontinuities or noise. The factors at which photo brightness alters sharply are commonly prepared into a hard and fast of curved line segments termed edges. Different colors have unique brightness values of precise color. Green photo has greater brilliant than crimson and blue photo or blue photo is blurred photo and crimson photo is the excessive noise photo [26].

Canny Edge Detection

The Canny Edge Detector is one of the maximum typically used photo processing gear detecting edges in a totally strong manner. It is a multi-step system, which may be applied at the GPU as a chain of filters. Canny area detection method is primarily based totally on 3 fundamental objectives [31].

Low blunders rate

All edges must be found, and there must be no spurious responses. That is, the edges have to be as near as feasible to the proper edges [21][30].

Edge factor must be properly localized

The edges placed have to be as near as feasible to the proper edges. That is, the gap among a factor marked as an area via way of means of the detector and the center of the proper area must be minimal [29].

Single edge point response

The detector must go back best one factor for every proper area factor. That is, the wide variety of neighborhood maxima across the proper area must be minimal [34].

Image Matching

Recognition strategies primarily based totally on matching constitute every elegance via way of means of a prototype sample vector. An unknown sample is assigned to the elegance to that's closest in phrases of predefined metric. The most effective technique is the minimal distance classifier, which, as its call implies, computes the (Euclidean) distance among the unknown and every of the prototype vectors. It chooses the smallest distance to make choice. There is every other technique primarily based totally on correlation, which may be formulated without delay in phrases of pictures and is pretty intuitive. We have used a very unique technique for photo matching.

Comparing a reference photo with the actual time photo pixel via way of means of pixel. Though there are a few risks associated with pixel primarily based totally matching however it's miles one of the pleasant strategies for the set of rules that's used with inside the mission for choice making. Real photo is saved in matrix in reminiscence and the actual time photo is likewise transformed with inside the preferred matrix. For pictures to be identical their pixel values in matrix have to be identical. This is the most effective reality utilized in pixel matching. If there's

any mismatch in pixel fee it provides directly to the counter used to calculate wide variety of pixel mismatches. Finally, percent of matching is expressed as final output [32].

ADVANTAGES AND DISADVANTAGES

Many researchers have worked on devising and execution of IoT based traffic control systems. The execution of these systems has been successful. The system would be able to perform involuntarily rooted on data collection of vehicle density image received by the server from the particular region. The results acquired reveal that the platform of IoT eases the observing of traffic in the lanes. Police officers would be able to observe traffic situation in real-time [9]. One step forward MATLAB could be connected to platform of Thing Speak to evaluate the traffic information. Independent driving operations are made easy by this system. The researchers have put efforts to make these systems well-grounded users. Any of the complex algorithms can be applied for the execution of these systems and microcontroller's memory proportions do not pose trouble [13]. And few systems are made to direct signal time, as per levels of traffic in the roads, also assures preference to exigency vehicle. They can be performed with ease and fit out at any location and these systems are less expensive [28].

Nevertheless, there should be execution of processes by organizations to secure sensitive information as there is increase in complexity due to numerous sensors and network interconnected devices, every IoT system has to be tractable with policies of security. This compels it speculative to control all the finishing line. A lot of IP address is required to be managed, toil with larger volumes of information, and deal with more complicated IT framework. Networks are required to be scaled in order to accommodate as the output information of IoT grows due to addition of workflows and controls. It can get better by application of encryption, authentication of the system, or by controlling user access [34].

Applications

In Cities data from feeds of CCTV can be extracted and vehicle associated information can be sent to traffic control stations. This information can be integrated with information from the smart parking sensors, smart traffic signals, and smart accident assistance. Some uses of IoT-based traffic management include Smart parking, as getting area for parking

in urban areas are time consuming. The smart parking system could be modeled using IoT hardware, RaspberryPi and Arduino boards. Real-time information regarding void parking space for vehicle can be acquired by the IoT rooted sensors. Traffic lights are another application in which Sensors that are positioned strategically are able to apply technology of IoT to extract data. The data collected can be examined to give drivers with alternative paths and traffic signals will be improved. Road-side lights is the application of IoT based traffic control system in which Smart lights could be applied by employing environmental sensors for increasing or reducing brightness suitable to present light situations. Smart assistance is also an application in which accidents and extremities can be recognized using sensors and CCTV in the lanes and send their locality to teams of emergency [24][25][19].

CONCLUSION

Nowadays, Traffic congestion is the important issue in the case of transport system in the countries which are still developing [7]. This allows rise in fuel expenditure and also leads to air contamination. The combination of technology of computer vision with that of IoT aids in building intelligent system that can control traffic in an efficient way. A few effective traffic system networks are built which gives drivers with real-time update about the state of roads through a website [18]. IoT rooted smart roads improve commuting time, safety on road and decrease traffic jams. These systems can be executed using any complex algorithms. These system set up costs less and they are movable systems which leads to reduced traffic crowding [22]. The mechanized system decreases time spent by travellers on the traffic signals and also decreases traffic crowding on busy roads. It also guarantees safety of pedestrians [3].

FUTURE WORK

The system has to be specially made for remote observing and management of traffic on roads. Some works of researchers needs to be improved by building website for observing and managing separately by node –red dashboard. The systems can support many combinations like detection of event and failure alert message [3]. Different systems like parking machines, traffic counting stations and city observing camera when integrated provides a good management. Real-time categorizing of information on various kinds of vehicles can be made possible by allowing the whole vehicle

testing procedure [11]. Experiments needs to be expanded to private cloud in the direction of areal fog computing. With the aid of the augmented reality important information like speed and path of movements can be observed. This would give on to a city with smart and high-tech framework. The traffic control system using IoT is an important step which can lead to the building of smart cities in the future [26][34].

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