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DENSITY BASED TRAFFIC CONTROL SYSTEM USING CANNY EDGE DETECTION ALGORITHM

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Abstract
As the problem of urban traffic congestion intensifies, there is a pressing need for the introduction of advanced technology and equipment to improve the state-of-theart of traffic control. The current methods used such as timers or human control are proved to be inferior to alleviate this crisis. In this paper, a system to control the traffic by measuring the realtime vehicle density using canny edge detection with digital image processing is proposed. This imposing traffic control system offers significant improvement in response time, vehicle management, automation, reliability and overall efficiency over the existing systems. Besides that, the complete technique from image acquisition to edge detection and finally green signal allotment using four sample imagesof different traffic conditions is illustrated with proper schematics and the final results are verified by hardware implementation In this project we are describing concept to control or automate green traffic signal allotment time based on congestion available at road side using Canny Edge Detection Algorithm To implement this technique we are uploading current traffic imageto the application andwill extract edges from images and if there is more traffic then will be more number of edges with white colour and if uploaded image contains less traffic then it will have less number of white colour edges Empty edges will have black colour with value 0. By counting number of non-Zeroes white pixels we will have complete idea of available traffic and based on that we will allocate time to green signal. If less traffic is there then green signal time will be less otherwise green signal allocation time will be more.

Introduction

Traffic congestion is one of the major modern-day crisis in every big city in the world. Recent study of World Bank has shown that average vehicle speed has been reduced from 21 km to 7 km per hour in the last 10 years in Dhaka [1]. Intermetropolitan area studies suggest that traffic congestion reduces regional competitiveness and redistributes economic activity by slowing growth in county gross output or slowing metropolitan area employment growth [2].As more and more vehicles are commissioning in an already congested traffic system, there is an urgent need for a whole new traffic control system using advanced technologies to existent infrastructures to its full extent. Since building new roads, flyovers, elevated expressway etc. needs extensive planning, huge capital and lots of time; focus should be directed upon availing existing infrastructures more efficiently and diligently. Previously differenthad been proposed, such as infra-red light sensor, induction loop etc. to acquire traffic date which had their fair share of demerits. In recent years, image processing has shown promising outcomes in acquiring real time traffic information using CCTV footage installed along the traffic light. Different approaches have been proposed to glean traffic data. Some of them count total number of pixels [3], some of the work calculate number of vehicles These methods have shown promising results in collecting traffic data. However, calculating the number of vehicles may give false results if the intravehicular spacing is very small (two vehicles close to each other may be counted as one) and it may not count rickshaw or auto-rickshaw as vehicles which are the quotidian means of traffic especially in South-Asian And counting number of pixels has disadvantage of counting insubstantial materials as vehicles such as footpath or pedestrians. Some of the work have proposed to allocate time based solely on the density of traffic. But this may be disadvantageous for those who are in lanes that have less frequency of traffic. Edge detection technique is imperative to extract the required traffic information from the CCTV footage. It can be used to isolate the required information from rest of the image. There are several edge detection techniques available.

They have distinct characteristics in terms of noise reduction, detection sensitivity, accuracy etc. Among them, Prewitt [7], canny [8],Sobel [9], Roberts and LOG are most accredited operators. It has been observed that the Canny edge detector depicts higher accuracy in detection of object with higher entropy, PSNR(Peak Signal to Noise Ratio), MSE(Mean Square Error) and execution time compared with Sobel, Roberts, Prewitt, Zero crossing and LOG.**I**NDIA is the second most populous Country in the World and is a fast growing economy. It is seeing terrible road congestion problems in its cities. Infrastructure growth is slow as compared to the growth in number of vehicles, due to space and cost constraints [1]. Also, Indian traffic is non lane based and chaotic. It needs a traffic control solutions, which are different from the developed Countries. Intelligent management of traffic flows can reduce the negative impact of congestion

EXISTINGSYSTEM

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PROPOSED SYSTEM

Edge detection technique is imperative to extract the required traffic information from the CCTV footage. It can beusedtoisolatetherequiredinformationfromrestoftheimage.Thereareseveraledgedetectiontechniquesavailable.Theyhavedistinctcharacteristicsintermsofnoisereduction,detectionsensitivity,accuracyetc.Amongthem,Prewitt[7], canny [8],Sobel [9], Roberts and LOG are most accredited operators. It has been observed that the Canny edgedetector depicts higher accuracy in detection of object with higher entropy, PSNR(Peak Signal to Noise Ratio),MSE(Mean Square Error) and execution time compared with Sobel, Roberts, Prewitt, Zero crossing and LOG [10-12].

In this paper, a system in which density of traffic is measured by comparing captured image with real timetraffic information against the image of the empty road as reference image is proposed. Here, in figure 1, the blockdiagramfor proposedtraffic controltechnique isillustrated

Implementation

Tensor flow

Tensor Flow, an open-source, free framework, is utilized for dataflow and distinguishable programming across a range of tasks. It is a symbolic math framework that is also used by machine learning programmers that use neural networks. It is utilized by Google for purposes of research and manufacturing. To work in machine learning, it is a requirement in the industry to have TensorFlow experience. The Google Brain team created TensorFlow for usage within Google. On November 9, 2015, it was made available under the Apache 2.0 open-source licence.

TensorFlow may operate on an assortment of CPUs and GPUs thanks to available CUDA and SYCL enhancements enabling general-purpose computation on graphics processors. TensorFlow is supported by Linux 64-bit, macOS, Windows, as well as mobile operating systems including Android and iOS. Computing might be easily distributed across a variety of platforms (CPUs, GPUs, and TPUs) including PCs, server clusters, mobile devices, and edge devices thanks to its modular design. TensorFlow calculations are represented by autonomous dataflow graphs.

Pandas

Pandas serve as an open-source Python toolkit that provides outstanding performance data analysis and manipulation tools utilizing its powerful data structures. Python was primarily employed for data munging and preprocessing. On analysis of data, it had little of an effect. Pandas discovered the answer. No matter where the data came from, we may use Pandas to carry out the five typical steps of data processing and analysis: prepare, modify, model, and evaluate. Many academic and professional fields, including finance, economics, statistics, analytics, etc., use Python with Pandas.

Numpy

NumPy is a general-purpose library for managing arrays. It provides an extremely quick multidimensional array object and also the ability to interact with such arrays. This Python package is fundamental to scientific computing.

Matplotlib

Publication-quality graphics are produced in a variety of tangible formats and cross-platform interactive environments using the Python 2D plotting package Matplotlib. Matplotlib can be used with several graphical programming toolkits, the Python and IPython shells, the Jupyter notebook, web application servers, and Python scripts. Matplotlib tries to render simple things straightforward while making challenging things doable. You can make graphs, histograms, power spectra, bar charts, error charts, scatter plots, and many more with merely a few lines of code. For instances, view the sample plots and thumbnail galleries. The pyplot package provides a MATLAB-like interface for simple plotting, especially when utilized in the context of IPython. Power users are given total control over line styles, font settings, axis characteristics, etc. through an object-oriented approach or other technique.

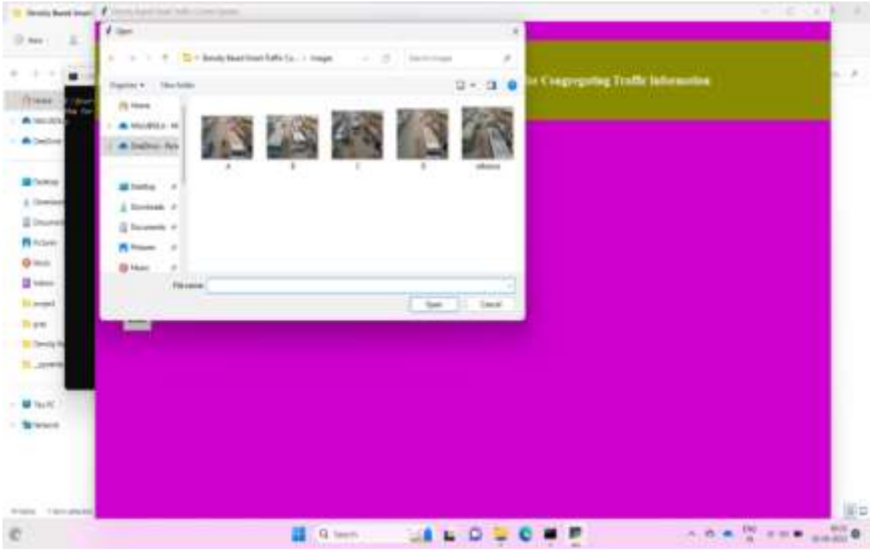
MODULES

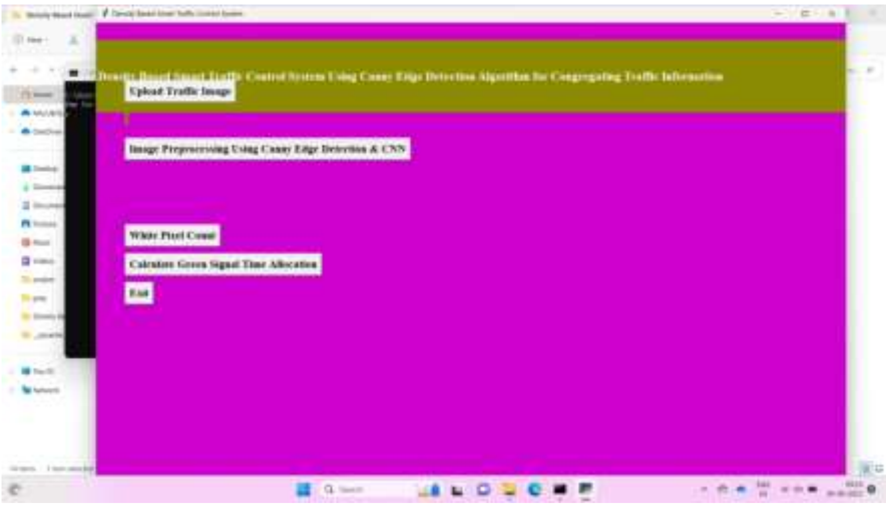
Toimplementthisprojectwehavedesignedfollowingmodules

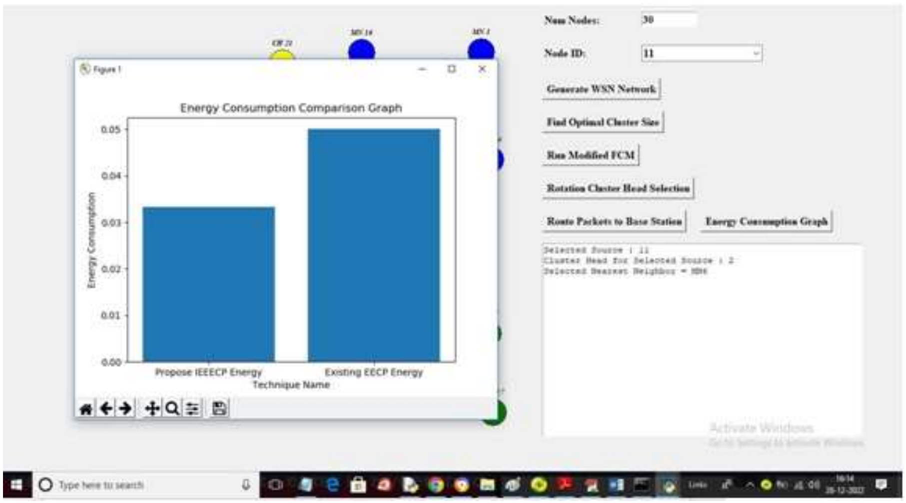
1) GenerateWSNNetwork:usingthismodulewewillgeneratesomerandomWSNnodesaswe don’thaverealsensors sowe aregeneratingvirtualnodes
2) Find Optimal Cluster Size: using this module we will calculate X and Y location ofeach node and then using formula given in paper we will calculate Optimal number ofcluster.
3) Run Modified FCM: using this module we will cluster all nodes using FCM and ifcluster size < cluster threshold then we will call Modified FCM. (all this technique weareshowinginabovecodescreens)
4) RotationClusterHeadSelection:usingthismodulewewillselectclusterheadforeachcluster
5) Route Packets to Base Station: using this module we will select Source IOT and thenfinditsclusterheadandthenclusterheadwillfindnearest neighbourtoroutepackettobase station
6) Energy Consumption Graph: using this module we will plot energy consumption forproposeandexistingpathselectionbasedondistance

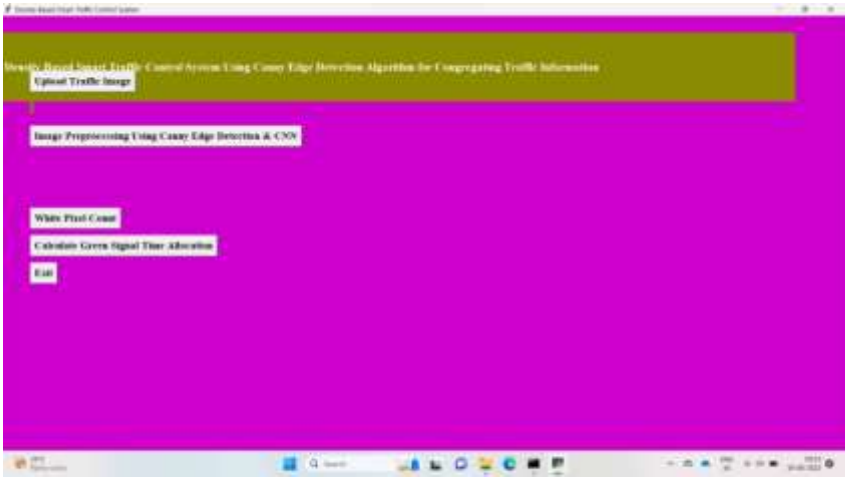
Results and Analysis

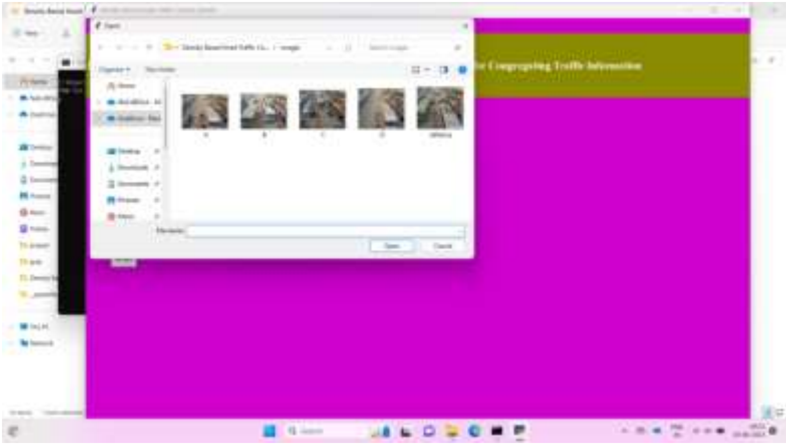
Torunprojectdoubleclickon‘run.bat’filetogetbelowscreen insamecluster.Intext areawecanseewhichnodeisinwhichcluster.Nowclickon‘RotationClusterHeadSelection’buttonto selectcluster headforallclustersand getbelowoutput.



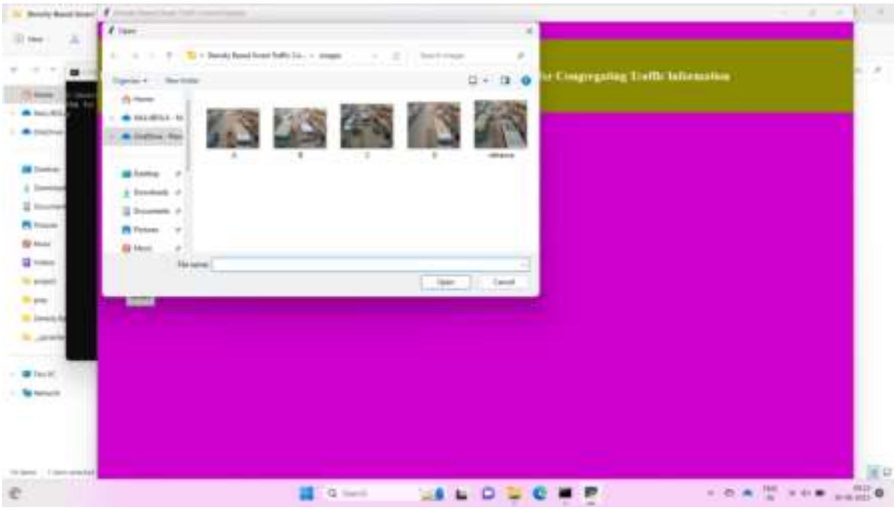

Density Based Smart Traffic Control System Using Canny Edge Detection Algorithm for Congregating Traffic Information
Upload Traffic Image
Image Preprocessing Using Canny Edge Detection & CNN
White Pixel Count
Calculate Green Signal Time Allocation
Exit


Num Nodes:
30
Node ID:
11
Generate WSN Network
Find Optimal Cluster Size
Run Modified FCM
Rotation Cluster Head Selection
Route Packets to Base Station
Energy Consumption Graph
Energy Consumption Comparison Graph
Energy Consumption
Propose IEEECP Energy
Existing EECP Energy
Technique Name





Inabovescreenfromdropdownbox Iamselectionnode11andthenclickon'RoutePackettoBaseStation'buttontoget belowoutput.



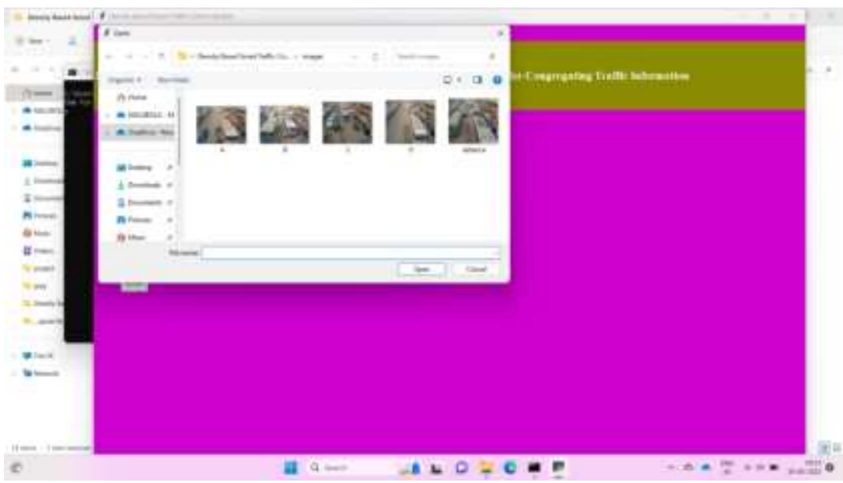
In above screen black line indicate data sending from source to base station where MN 11 isthesourcenodeandCH2istheclusterandMN6isthenearestneighbourtobasestation.Samepathdetailswecanseeint ext areaalso and similarlyyoucanselectanysourcenodeandroutepacketsto destination.Nowclick on'EnergyConsumptionGraph'buttonto getbelowgraph

TESTING AND VALIDATION

S. No.	Test Case	Excepted Results	Results
1	No. of nodes	Enter required no. of nodes	Pass
2	Node id	Enter no. of id’s	Pass
3	Generate WSN Network	It forms the network	Pass
4	Existing AODV	IT generates the existing path	Pass
5	Route packet to BS	It generates the optimal path	Pass
6	Energy consumption graph	Shows efficient between existing and proposed	Pass

Table.1. Test Data

If we give node id more than given number of nodes then it will not generate any path between nodes.



CONCLUSION

In this significant work, we propose an improved energy-efficient clustering protocol (IEECP)to prolong the lifetime of WSN-based IoT network through overcoming the problems of the clustering structure that adversely affect the protocol performance. Evidently, the proposed protocol reduces and balances the energy consumption of nodes by improving the clustering structure. Hence, the IEECP is deemed suitable for networks that require a longer lifetime. In general, the results yield that the IEECP performs better than the existing protocols. Our proposed protocol will be a beneficial contribution to the field that will enhance the dailyoperationsinmanyareasoflife,whichutilizeWSNintheIoTworld.Theenergyconsumptionof the network is analyzed to compute the optimal number of clusters based on the distance tothe CH in the case of the overlapping clusters. Then, the modified FCM algorithm (M-FCM)isproposedbycombiningitwithacentralizedmechanismtoformstaticandbalancedclusters.Finally,anewCHselection-rotationalgorithm(CHSRA)ispresentedbyintegratingtheback-off timer mechanism for the CH selection with the rotation mechanism for CH rotation. TheCHSRA has relied on a new objective function for selecting CHs in optimal locations tobalance the energy consumption among CHs for the clusters. Furthermore, it has relied on anew dynamic threshold for CH rotation within members of clusters to balance the energyconsumption for the successive CHs in the cluster. In future work, we aim to enhance theprotocol by improving the FCM algorithm concerning the random initial selection. Moreover,we believe that improving the objective function of CH selection through the reliance onweightedenergy-based distanceforadjacentCHsisalsocruciallysignificant.

FUTURE SCOPE

The future scope of an improved energy-efficient clustering protocol for WSN-based IoTsystems is promising and encompasses several areas of development. Here are some potentialavenuesforfuture researchandadvancements:

Advanced Machine Learning Techniques: Integration of machine learning algorithms, such asreinforcement learning or deep learning, can further optimize the clustering process. Thesetechniques can learn from network data and make intelligent decisions regarding cluster headselection,energymanagement,androuting,leadingto evenmoreenergy-efficientprotocols.

IntegrationofRenewableEnergySources:Futureclusteringprotocolscanexploretheintegrationofrenewableenergysources,suchassolarorwind,topowerthesensornodes. Thiswould reduce dependence on battery power and enhance the energy sustainability of IoTdeployments,extendingthenetworklifetime.

DynamicAdaptationtoHeterogeneousEnvironments:IoTdeploymentsoftenencounterdiverseenvironmentalconditions,suchasvaryingnodedensities,mobilitypatterns,orinterference levels. Future protocols can focus on dynamically adapting clustering strategiesbasedonthesechangingenvironmentstooptimizeenergyefficiency.

IntegrationwithEdgeandFogComputing:Incorporatingedgeandfogcomputingcapabilitiesintoclusteringprotocolscanenablelocaldataprocessingandreducecommunicationoverhead.This can further conserve energy and extend the network lifetime by minimizing unnecessarydatatransmissions tothecentralserver.

SecurityandPrivacyConsiderations:AsIoTsystemsbecomeincreasinglyinterconnectedandhandle sensitive data, security and privacy concerns become paramount. Future clusteringprotocols should address these challenges by incorporating robust encryption, authenticationmechanisms, and privacy-preserving techniques to ensure the integrity and confidentiality ofdata.

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