Information and Communication Technology Enabled Model for Efficient Detection of Indian Street Dejection

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Abstract

Major trouble to Indian road surface is the potholes, cracks and patches. This problem reduces moving speed of vehicles and leads to inefficient communication. In this paper we proposed an approach for development and implementation of ICT enabled model for efficient identification and maintenance of Indian road distress. The entire work can be carried out by noise detection and removal, parameter extraction from road images, classification framework for road condition detection and maintenance.

Keywords: *Indian Road Network, Noise Detection and Removal, Parameter Extraction, Maintenance*

1. Introduction

As India is best ever developing country in the world. With the augmentation of the population road networks are endlessly growing. Considering the strong correlation between economic development and quality of road network it is vital to progress toward better road networks. ICT enabled strategies are increasing in India for developing smart nation.

2. Literature Survey

Manual surveys procedures for road distress detection are time intense. Classy outcome is the current main concern to determine safeguarding issue for road community in India. Expertise put efforts to build up tools and machinery for detecting road distress and to classify them. Much of the work focused using approach of Neural Network, Fuzzy logic, Genetic Concept, Image board, Sensor and Global Positioning System.

Amita Dhiman et al. [1] worked on an urban dataset for pothole recognition utilizing stereo vision. The display depends on a RANSAC procedure that finds the commanding plane for finding potholes being underneath surface level with v-divergence method. Wenji Li et al. [2] discussed street upkeep, used preventive maintenance as better approach for most governments. Author explored and developed a programmed and non-destructive visual investigation framework focusing on driving styles and setting, and street situation in Thailand, Bangkok.

Nilam Jalindar Mahadik et al. [3] proposed Pothole Detection framework for urban vehicle travel. Author developed street surface observing framework for computerized pothole discovery with remote sensors. Arun Kumar G. et al. [4] examined the past created pothole discovery strategies utilized Cell phone sensors to recognize the potholes and knocks by GPS sensor in the mobile telephone. Detected information is send to the distributed storage for additionally handling. This fills in as an important wellspring of data for the administration experts and vehicle drivers. An android and web application can be utilized to show the street condition in the guide.

Zhun Fan et al. [5] proposed computerized asphalt split recognition a convolutional neural system (CNN) to take in the structure of the breaks from crude pictures, with no pre-processing. Little fixes are

separated from break pictures as contributions to create an extensive preparing database, with changing +ve and –ve values. Author worked on 2 datasets and 5 earlier used methodologies and found satisfactory results than existing method.

Tom B.J. Coenen et al. [6] used computerized strategies to catch distinctive troubles on asphalt small scale surface. Profundity related upsets are detectible genuinely well, however depend on costly apparatuses. Cafiso S. et al. [7] proposed street asphalt administration. Distress location and characterization infield analysis and alignment of a Probabilistic Neural Network Classifier is exhibited for getting trouble measures from programmed frameworks.

M.D. Phung et al. [8] address the issues of break location. Approach incorporates two phases, information gathering utilizing unmanned airborne vehicle and break detection with histogram assessment. For data gathering, 3D model is proposed with laser scanners. Geometric properties are detached to serve vital for exploring the UAV to take pictures of the structure acquired from the enclosed field. The consequent picture grouped by histogram assessment and peak place. Splits are distinguished by close versatile edges.

Markus Eisenbach et al. [9] presented a framework for street condition procurement and appraisal as the way to ensure their changeless accessibility. In the work, they present the GAPs dataset, recorded by an institutionalized procedure satisfying German government directions, and itemized trouble explanations. Moreover, they presented assessment for cutting edge in asphalt trouble recognition and an examination of the adequacy of best in class regularization procedures on the dataset. Lucy Powell et al. [10]worked on strong strategy for robotized discovery and appraisal of potholes, splits and fixes from pictures of Indian nearby streets, where impact of shadow is amended. For testing its execution, the proposed strategy has been actualized utilizing MATLAB. The outcomes are assessed through exactness and accuracy review measurements and contrasted and the strategies exhibited by before scientists and additionally current practices in the field.

Dejin Zhang et al. [11] focused on deformities of black-top asphalt trouble. Much consideration has been paid to splits; a versatile thresholding technique is introduced for picture division by completely considering the spatial appropriation, forces and geometric highlights of splits; Region of Belief (ROB) is acquainted with encourage the ensuing location by characterizing some believability factors which demonstrate the unwavering quality that a locale could be named as a misery area which contains breaks, and a calculation to concentrate such ROBs is conceived in like manner propounded for break discovery. Analysis performed firstly on 10,000 of field-caught pictures considered from various street situations. Secondly finished utilizing a benchmark dataset for an examination with previous ongoing productions. The assessment execution is agreeable for a wide range of breaks. For particular information, the discovery exactness is more than 95% and over 90% of intelligible splits without separated sections have been accurately recognized as the incorporated ones. For the benchmark information, discovery execution likewise beats already distributed outcomes and approach has been generally connected in China.

3. Proposed Architecture

The main blocks of road distress identification are data accumulation using mobile capture devices and coordinates from GPS devices. Image normalization, parameter extraction, finding influential parameters, automated detection of road condition, building road repair scheduler, using weather forecaster with weather sensors road condition verification.

The entire flow diagram for Development and Implementation of ICT Enabled Model for Efficient Identification of Indian Road Distress using Image Processing is shown in [Fig.1].

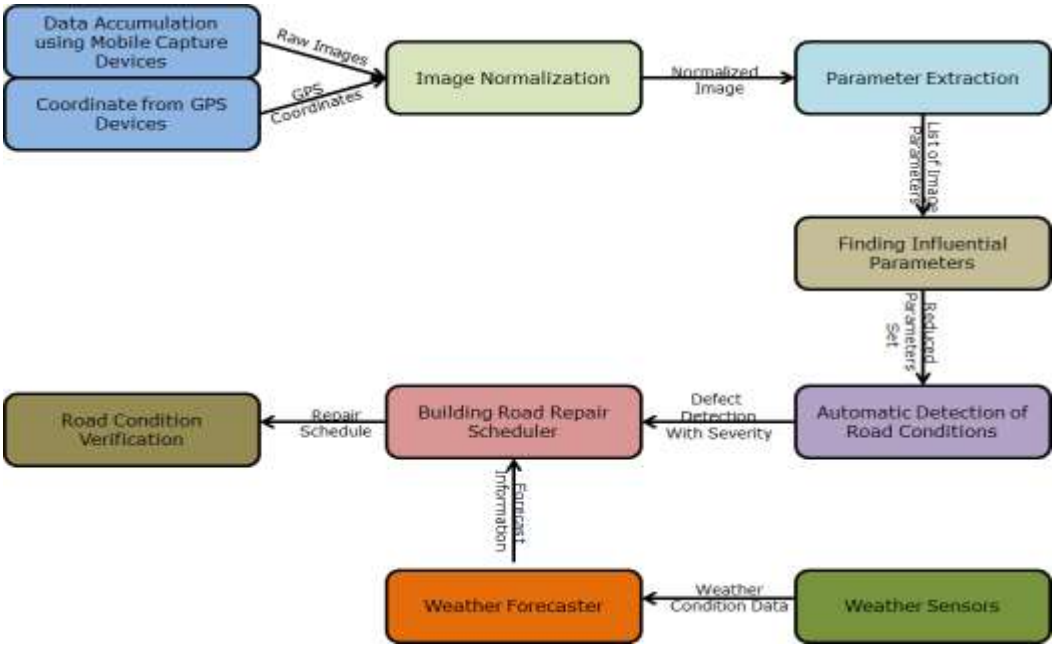

Fig.1 Process Flow/ Block Diagram for Road Distress Identification

The initial data accumulation is done using the in vehicle mobile capture devices. The capture devices are web enabled and the data is directed collected to the processing server. At the same time the data from the GPS devices, also mounted along with the in vehicle capture devices sends the coordinate details to the processing server for storage. Further, the on the image processing server, the collected images are processed in order to find the type of noise and blur present in the images. Once the fault types are identified, the proposed adaptive algorithm removes the noises and blurs effects from the images.

Henceforth, the parameter extraction processes on the normalized images are performed and the text dataset is prepared from the image dataset for further processing. Advancing, Using the novel information gain algorithm, the most influencing parameters are extracted for reducing the time of detection of defects. Next, the proposed algorithm detects the defects on the road surface based on the predefined and analysed thresholds for all the defect types. Similarly, the deployed weather sensors, which are also web and ICT enabled, capture the weather condition data and forward to the weather forecaster module.

The weather forecaster module, forecasts the weather conditions based on the available inputs and predicts the weather conditions. In the other hand, based on the severity of the defects on the road surface, the repair scheduler performs the scheduling. The weather forecaster influences the repair schedule and the coordinate details collected from the in vehicle GPS devices guides the appropriate group team. Finally, the road condition after the repair process is updated using the same in vehicle devices.

4. Implementation Approach

Our work is classified into 3 levels:

4.1. Automatic Noise Detection and Removal

It analyze and consider the issue for complete automated ICT enabled model from capturing images, transmitting and providing repair solutions. In image processing, the recognition of facial image is the prime area of research for many decades. Many scholars have proposed mechanisms for admirable recognition of facial figures for security, efficient data management, automations and emotion detection.

The set of facial figure is dependent powerfully on the image capture agents. Thus, the researches on making the capture agents have also been carried out. Even though, good key bottleneck for better acknowledgment of facial figures are caused to random distortion and blurring to the source images to be provided as dataset to the recognition system as demonstrated by H. Cheng et al. [12] and X. Dai et al. [13].

Here we work by considering image from capture strategy. Calculated schema for image and represent the image with pixel values. In restoration phase we calculated image properties as pixel density, distortion and displacement. Further in noise removal phase we calculated pixel average distortion, identified noise type, calculate SNR. Moreover, we removed the noise by comparing SNR. For reduced SNR we stop execution or else go on with blur elimination.

Considering the requirement of making image noise and blur free detection and restoration of blur images is primary. Firstly, Adaptive process for noise type identification identifies the type of noise. Our algorithm identifies noise correctly with 100% success rate. Secondly blur angle estimation result difference between estimated angle and actual angle required to be 0. Positive difference indicates, predictable slant is lower than actual distorted slant, negative difference indicates predictable slant is higher than actual distortion slant. Thirdly image length restoration results renovate the image length for better resolution.

Finally, Signal to noise ratio (SNR) analysis is calculated. If SNR increases, then it is unsuccessful restoration practice. So, SNR must cut down.

The entire automated noise detection and removal details are available in work of Suwarna Gothane et al. [14].

4.2. Framework for parameter extraction from road images

We considered following parameter for road distress identification:

Entity No., greatest distance between Entity, vertical distance at middle, average perpendicular size, region. Novel parameter extraction framework takes 3.23 Sec to build model with parameters on dataset of Indian Surface Maintenance Authority Samples using Matlab Image Processing Toolbox and Windows file system API.

The entire automated parameter mining procedure details discussed in work of Suwarna Gothane et al. [15].

4.3. Classification framework for road condition detection and maintenance

To analyze and predict the road damage and recommend the suitable maintenance task we classified defect under 3 classes Class A as patchworks, Class B as cracks, Class C as potholes with respective threshold values in the ranges potholes. So finding the distress category and potential of enlargement into the upper class of distress, framework specifies the repair suggestions.

Framework works with the external weather Application programming interface Open Weather Map to generate the weather forecast report for maintenance plan. API is called by type CITY Name, By city ID, By Coordinates, By ZIP Code.

The climate data gathered helps in decision supportive formats. Weather data parameters includes Record Id, Longitude, Latitude, Cloud, Current Temp, Max Temperature, Min Temp, Pressure, Humidity, Visibility, Wind Speed, Wind Direction, Country Code, Sunrise Time, Sunset Time and City Name.

The entire An Automatic categorization formation for road situation recognition and safeguarding prediction results are discussed in work of Suwarna Gothane et al. [16].

5. Conclusion

In this paper we proposed an approach for development and implementation of ICT enabled model for efficient identification and maintenance of Indian road distress. The work carried out by noise detection and removal, parameter extraction from road images, classification framework for road condition detection and maintenance.

The technique is tried on three databases and contrasted with four existing strategies. Exploratory outcomes reveal that it beats alternate techniques.

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