

Counting students using OpenCV and Integration with Firebase for Classroom Allocation

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Abstract— In universities, lectures must be taught in suitable classrooms or labs in case of practicals. A major problem is students not attending lectures and because of this the classroom space, labs and infrastructure are wasted. If the management is done manually then it becomes a very tedious task. Our system aims to overcome this problem by using technologies like OpenCV to get the count of students present in the class and then developing an algorithm which gives the best occupancy ratio. Our educational system will be different than the traditional one. To count the number of students in a class, detectMultiscale method is used and for dynamic allocation of a classroom, occupancy ratio is used. First, detectMultiscale method will be used to identify the person in the image, it will not consider any objects. This count is stored into the firebase which is used for prediction and secondly, for dynamic allocation of a classroom, occupancy ratio is used, this will reduce the wastage of space and also helps in efficiently planning the schedule. The factors like classroom size, classrooms equipped with projectors, course capacity are taken for dynamic allocation. The cloud platform provided by Google (Firebase) is used for maintaining and storing data of the respective college/University. This data consists of personal data, timetables, schedules, attendance sheets.

Keywords—*detectMultiscale, firebase, occupancy ratio, dynamic allocation*

I. INTRODUCTION

Many studies have shown that the attendance of students in universities shows a falling trend over the years. A research

was carried out in engineering colleges in Gujarat by Khushbu Vaishnav [1] and it showed that there were various factors involved in the low attendance such as lack of interest or lack of good-teaching skills, other extracurricular activities like part-time jobs or availability of online content. This has shown an interesting relation with the poor grades [2], hence it is a major concern for Universities which provide world class libraries and expensive laboratories equipped with projectors, computers.

D. B. Varley in 1998 [3], defined space allocation as the allocation of any room, lab, hall or spacious areas for any particular use. This use should be optimum as in minimum wastage should be done of the allocated resources.

Classroom allocation is of utmost importance since a huge amount of money is spent on the classes which are expected to accommodate the students and provide them with facilities like computers, projectors as per the requirement. Effective utilization of space means that the classrooms are utilized to their maximum occupancy by the students.

Currently, this is being done manually in many universities which requires the cooperation and involvement of many departments which becomes a very slow and hectic task. Our system will do it dynamically.

This system aims to achieve a high occupancy ratio. Occupancy ratio is the ratio of the used space to the total space.

This system will help in efficiently managing the resources and also planning the schedule which will benefit both the

Gesture Controlled Home Automation using CNN

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Abstract- As technology is rising, more advancements are made in making the life of people easier, by providing methods for easy monitoring and managing. In this paper, a Home Automation model is designed to provide ease of control of home appliances, using an android application. The elderly and physically challenged people can perform their day-to-day activities efficiently. In previous methods, accelerometers are used to monitor the activity, which are accurate but are not flexible and portable. The proposed system detects the gestures given as input by the user and controls the home appliance. The client interface is responsible for capturing the input gesture from the user, using an android application and uploading it on the raspberry pi server. Raspberry pi acts as an important preprocessor. Backend Processing involves image preprocessing, training the CNN model, and prediction of image class category of input gesture image. Based on this predicted class of image, the respectively assigned action takes place at the home interface.

Keywords— Convolutional Neural Network, filtering, home appliances, gesture recognition, grayscale, image classification, resizing

I. INTRODUCTION

Recently the scope for gestures has been increased for interaction with consumer electronics and mobile devices. Traditional home automation systems are not suitable for aging populations or disable persons. Whereas gesture-based automation provides an advantage to those people who are physically unable for efficiently performing the day-to-day activities. The objective of the proposed system is to create a system that can control home appliances using any one of the two assigned methods: - 1. Gesture-based 2. Web-based.

Disabled or old aged people who can't walk require an effortless way of accessing things around them which must be served systematically and efficiently. This idea integrates automation with technology. The primary goal of the system is to develop a tool that uses gesture recognition for reducing the barrier in communication between the deaf and dumb and normal people.

II. LITERATURE SURVEY

A system is proposed in [1] where the classifications for sign recognition and detections are done automatically. The real-time image format is in RGB which needs to be preprocessed for clearing out various gestures in the image. The MATLAB Rb is used to simulate the proposed sign language classification system. In this paper [2], the tedious technique of classifying a single gesture is avoided, whereas the system classifies multiple gestures at the same time. They have used Long Short Term Memory (LSTM) based deep network, motivated by Encoder-Decoder architecture, that classifies gesture sequence accurately in one go. It is a system, based on a multilayer fuzzy neural-network-based classifier. A system with maximum efficiency, low cost, an optimal mixture of methods, giving results against complex backgrounds as well, should be preferred. ANFIS is the preferred method by their system. The system [3] is so designed that it recognizes nine gestures of sign language in real mode using MATLAB, the PCA algorithm is used to recognize signs. Signs are captured through the web camera and YCbCr color transformation model used for feature extraction. PCA compares features of the captured image with the training database and calculate minimum

Twitter Sentiment Analysis Using Machine Learning For Product Evaluation

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Abstract— Twitter, a micro-running a blog website, is a massive repository of public opinions expressed in the direction of numerous humans, offerings, companies, merchandise, etc. Sentiment evaluation is the system of analyzing one's public evaluations. Sentiment analysis whilst combined with twitter offers beneficial insights into what's expressed on Twitter. The big availability of online evaluations and postings in social media gives invaluable feedback for groups to make better knowledgeable choices in guidance their marketing techniques towards user's pastimes and alternatives. Sentiment evaluation is, therefore, vital for determining the general public's opinion toward selected services or products. This paper emphasizes the different techniques utilized for classifying the product critiques (which can be within the form of tweets) according to critiques expressed in tweets to analyze whether or not the massive behavior is positive, negative or neutral and use of that analysis for the evaluation of product market. Data used in this look at our online product critiques gathered from twitter and used to rank the satisfactory classifier for sentiments.

Keywords—Machine Learning; Sentiment Analysis; Twitter; Data Mining; Product Evaluation.

I. INTRODUCTION

Miniaturized scale blogging destinations, for example, Twitter have developed to turn into a wellspring of fluctuated sort of data. This is because of the nature of small-scale writes on which individuals post continuous messages about their suppositions on an assortment of themes, examines current issues, whine, and express positive assessment for items they use in day by day life [1]. The primary goal is to conduct sentiment analysis on tweets utilizing different machine learning algorithms that classifies the tweets into the positive or negative category. If the tweet has both negative and positive components, the more dominant component ought to be picked as the final

one. The tweets have emojis, usernames, and hashtags which are required to be processed and changed over into a standard structure. It also requires to extract features such as bigrams and unigrams. In any case, simply depending on a single model didn't give a high accuracy so selecting the model with high accuracy is taken into consideration. Truth be told, organizations assembling such items have begun to survey these small-scale online journals (blogs) to get a feeling of general estimation for their item [2]. Commonly these organizations study client responses and answer to clients on smaller-scale online destinations. One challenge is to fabricate innovation to identify and abridge a general feeling. As of late, countless individuals have been pulled in to interpersonal interaction stages like Facebook, Twitter, and Instagram [3]. Most utilize social destinations to express their feelings, convictions or suppositions about things, spots or characters [3]. Strategies for notion investigation can be sorted transcendently as AI, Lexicon-based and hybrid [3]. Correspondingly, another order has been given the categories of statistical, knowledge-based and hybrid approaches [3]. There is a space for performing testing research in expansive territories by computationally investigating feelings and conclusions. Accordingly, a progressive practice has developed to extricate the data from information accessible on interpersonal organizations for the expectation of a political decision, to use for instructive purposes, or for the fields of business, correspondence and showcasing [3]. The precision of sentiment analysis and predictions can be gotten by conduct examination dependent on informal organizations (social networks) like Twitter [3]. Twitter is one of the greatest open and uninhibitedly accessible information sources. So, this paper focuses on a large number of tweets to classify which contains positive

Vehicle classification in traffic surveillance system using YOLOv3 model

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Abstract— Vehicle detection and classification plays a vital role within the space of the traffic management system. There's an outsized area for the development during this system as associated with accuracy and exactness. Because of increasing traffic within the advanced occasions, it's basic to arrange a framework winning to keep up a record of vehicles going through a path or a street. Spontaneous identification of vehicle data has been broadly used in the vehicle identification and classification system. Applications of the system developed are often useful in the traffic signal controller, vehicle lane departure warning system. The techniques goal is to provide appropriate data about traveling vehicles with the exact count. The convolutional neural network technique models based on YOLOv3 is used. The input is given in the form of video and pre-processing is finished and also the output is gained i.e. the count of vehicles, classification of vehicles supported its sort and total variety of vehicle motion at a specific time.

Keywords— Convolutional Neural Network; YOLOv3; Vehicle Identification System; Vehicle Classification System;

I. INTRODUCTION

The development of intelligent traffic surveillance system has emerged as a very important issue in recent years. One of the foremost necessities operate of the system is analysing and extracting helpful data from recordings. Capturing the video of a specific time and analysing the frames of video converted into informative output.

Automatic recognition of vehicle data has been used enormously in the vehicle intelligent traffic system. Automatic vehicle detection plays a key role in road traffic control nowadays. Few examples of the applications of vehicle surveillance systems are traffic response system, traffic signal controller, lane departure warning system, vehicle accident detection and traffic density estimation. It is not easy to physically keep a count of the traffic data. As the population is going on increasing with the count of vehicles traffic is a major issue.

The primary goal is to classify the vehicles into different types using various video processing algorithms that classify the vehicles into categories such as car, bus, truck, bicycle, motorbike, etc. The vehicle classification is based on Deep Residual Network which shares the accuracy to the algorithm and edge stability over 11 types of data of vehicle objects (MIOvision Traffic Dataset) [1].

Image classification is not an easy task to perform.[2] Humans can effortlessly and naturally carry out the classification as this was the first skill that learned when were born. But when the data is huge and changing each second Convolutional Neural Networks can be used as they are designed to map data to an output variable. Convolutional Neural Network uses monocular vision-based vehicle detection methods focusing on region-based Convolution Neural Networks (RCNN) methods [3].

Waste Management Improvement in Cities using IoT

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Abstract—Garbage collection is one of the most critical problems faced by Municipal Corporation. While implementing the waste management in cities the biggest challenge is the management of waste in cost optimal way with high performance. The current process of collecting the waste, separating it and transporting the containers everyday which is a complicated process. This paper deals with the concept of waste management and the smart system for waste management with higher benefits to the society. The proposed system for waste management will use various sensors for sensing the type of waste and separate the waste in different categories and actuator to inform the management to collect the waste container. This system will save money and time compared to the already available process of waste management and also improves the society cleanliness.

Keywords— IoT, Segregation, Garbage Collection, Sensors, Waste Monitoring and Management.

I. INTRODUCTION

Management and disposal of waste is a challenge in today's world. The dumping of garbage wastes at open landfill sites is the common method of disposal. The disposal method of dumping in open land sites has an adverse effect on the environment. Due to dumping of waste in such an open environment it affects the health of human beings and also life of plants & animals [1].

The method used to treat the disposal of waste into water leads to contamination of surface and groundwater. It gives rise to diseases which affect the living things in environment. Disposing waste in water spreads unhygienic conditions. This process breaks down the beauty of the environment.

In India waste collectors play a crucial role in recycling process in many cities. Many waste collectors have chances of getting prone to various diseases. The job of rag pickers (waste collectors) is a hectic task, also to eliminate the process of rag picking; it can be automated at the waste disposal zone by segregating at early stage. Until the waste is completely recycled its economic value is not realized. There are several advancements in

technology which has allowed reusing and recycle the waste. Generation of biogas for use of household works is possible due to waste management at small level.

To increase the potential of recovery and recycling, the waste can be separated into various types such as wet, dry, metallic waste, etc. Metal detectors can also be used for detection of metallic waste. The collected waste is the source of different useful gases and fertilizers [2].

The dry waste can be segregated further and can be reused and recycled. At present there are waste separation plants present on large scale, it is better to separate waste at collection level. By separating the waste during collection level, the quality of waste would be higher for recycling process. Hence the job of human waste collectors is reduced [3],[8]. Internet of Things (IoT) is among the technologies by means of which one can transfer data from one device to another using any type of network, at anytime and anywhere [4],[5].

Separation of waste is difficult task to do. It has to be cost efficient and easy to implement. This paper proposes a system which segregates urban household waste and manages it.

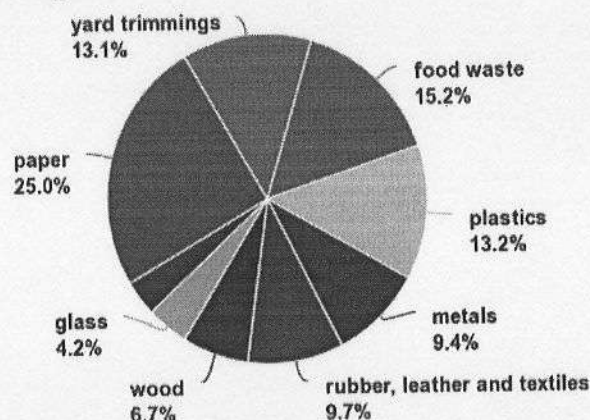


Fig.1: Statistics of Waste Source:Adapted [13]

System Model for Syntax Free Coding

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Abstract— Every programming language has its own attributes, advantages and its own syntax. The logical reasoning applied by the programmer also requires awareness of the syntax specific to that language. Writing correct code depends heavily on syntax proficiency. Perhaps this can be asserted as an impediment of general programming languages. The new learners of a particular programming language find it difficult to cope up with the syntax requirement of that particular language. This not only increases the time required to learn a language but also shifts the focus of the user from logical reasoning. In order to shun the tedious approach of learning the syntax of a language, the approach of converting the user's logic drafted in natural language directly into the appropriate programming syntax can be used. This approach will not only grant the user the ability to use natural language but will eliminate the syntax dependency as well. Since logic construction for a solution to a problem is constrained by the syntax of a programming language, we propose a system that allows the user to provide a simple English statement as input to the system, which will then be translated into syntactically correct code.

We show that the system works efficiently with more than 80% accuracy. With each iteration, the dataset gets trained and updated, further increasing the precision and recall of the system. We also convey that, with the help of this system the syntax dependency can be eliminated, thereby increasing the user's efficiency.

Index Terms—artificial intelligence, natural language processing, machine learning

I. INTRODUCTION

Programming means writing how to solve a problem in a language that the computer will understand, making it intelligent to execute the program and determine the solution to the problem. For learning any designated programming language, the first step is to assimilate the syntactical terms. From basic operations to arduous functions, everything is governed by strict syntax labeling. We plan to eliminate this syntax dependency and allow the user to extensively focus on logical reasoning, saving his time and efforts by understanding the natural language and converting it into the pertinent syntax. Natural Language Processing (NLP) is the method to understand the meaning behind the words. NLP is a component of Artificial Intelligence (AI) and is used to interpret the text and use it in various strenuous applications. In this manifestation, NLP interprets the meaning behind given text and that output is then converted into the apt syntax. Text Interpretation and Text Translation are two techniques used here. A program is generally an algorithm that instructs the computer to perform a specific task. There are different programming languages with the help of which you can write a program. Some of the languages have a syntax that is easy to learn, whereas on the other hand, for some of the programming languages, learning the syntax is exhausting.

II. HYPOTHESIS

We hypothesize that our system will allow the user to

give text commands using the spoken language and will translate the given statements into a suitable code. The system is aimed for around 70-80% accuracy, provided that the user uses English with grammatical mistakes. The system will generate a code that is free of syntactical errors, but the program may consist of logical and/or semantical errors, as the code generated is the exact translation of the input statements provided by the user.

III. RELATED WORK

A. *VoiceGrip: A tool for Programming-by-Voice*

Desilets [1] proposed a unique approach for Voice Programming where programmers first dictate code using an easy to utter pseudo-syntax and then translate that automatically to native code in the appropriate programming language. It also addresses different problems in traditional Speech Recognition (SR) system used in programming-by-voice like large vocal and cognitive load, the Code navigation (which is moving the cursor and/or scrolling window to specific parts of the code) and the error correction, which is an issue for all voice input tasks. As for a Speech Recognition model, it is important that the user corrects every recognition error otherwise, the accuracy of the voice model will demean gradually over time. To tackle all these complications A. Desilets proposed a system (2000), which allows programmers to dictate code continuously and enables an effective form of local navigation. The system supports the mouse-free operation of all its functionality. When translating pseudo code to native code in a particular language, VoiceGrip uses a simple deterministic parsing algorithm. Language Construct, native symbols, and new symbols are analyzed at each translation parameter to effectively translate the code. While VoiceGrip has been useful in practice for programmers-by-voice, it is still ineffective in untangling the complications in modern-day programming systems.

B. *VoiceCode.io*

The project was proposed by Ben Meyer [2] due to Repetitive Stress Injury (RSI) from overuse of keyboard. Voice-Code works with a commercial speech recognition program (Dragon NaturallySpeaking) and an editor (Emacs) to trans- late speech to code. The system needs the user to give input in the form of precise and strict syntax, character by character, certainly increasing the speed and efficiency of typing. The operations in the system are driven by building-blocks which are the basic command structures used in various languages. Initiating and channeling the blocks with certain command allows the user to use them for further tasks, which gets easier as the basic structure is already in place. User can also create multiple commands that does multiple things from a single initiation word. For example, a

Aspect Level Sentiment Analysis Approaches

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Abstract— The branch of sentiment classification is catching researchers' consideration in a couple of years, as social media is emerging rapidly on the internet. In sentiment classification or opinion mining reviews are gathered, analyzed and sentiments are determined. Reviews given by customers are helpful to other customers and manufacturers to formulate superior decisions and decide business strategies. There are various subareas in the branch of sentiment classification which has attracted the attention of academicians and researchers. In this review, the focus is on aspect-oriented sentiment classification; it also covers major work done in the sentiment classification area. This survey denotes major contribution of researchers in aspect-oriented sentiment classification using different approaches. Comparatively higher performances are reported for this referenced literature.

Keywords— *Sentiment analysis, Opinion mining, Aspect Based Sentiment Analysis (ABSA), Machine learning*

I. INTRODUCTION

Due to vast growth of social media on the internet, people came closer. People can specify opinions on blogs, websites, review sites. Customers can openly specify opinions related to products. A customer trusts on public reviews/opinions rather than information provided by the vendor. As this huge data is becoming available, it is necessary to extract it, analyze it, determine sentiments and present it in comparative form. Such review information is helpful for customers to take decisions and for vendors to compare products with other products available in the market and decide business strategies. ABSA plays important role in such applications. ABSA is also helpful to generate a summary of important factors specified in the review of products. It is useful for generating automatic recommendations based on purchase history, customer reviews and similarity between products. Such applications require a system to identify important aspects of the product and determine sentiments for it.

This survey focuses on ABSA and sentiment classification task. Techniques mentioned for sentiment classification are also used for determining sentiments for aspects. The organization of this paper is: section 1 is an introduction, section 2 covers sentiment classification work, section 3 is based on sentiment analysis approaches, section 4 focuses on ABSA and section 5 summarizes and defines its future scope.

II. SENTIMENT CLASSIFICATION

Sentiment classification is a technique which automatically classifies may evaluative text into classes like positive, negative as well as neutral. This classification should be done at a particular one of the three levels i.e. text level, sentence level, aspect opinion (feature level). The difficulty of classifying documents increases from document level to aspect-oriented sentiment classification [1].

A. Document Level

Text oriented sentiment classification classifies a document as a positive sentiment or a negative sentiment document. This level of classification may not give appropriate results as it does not consider different aspects of a product while analyzing sentiments. In a review, the user may give positive comments for one aspect and negative for another aspect, of the same product [1].

B. Sentence Level

It performs classification on sentence-level for a review [9]. It basically first identifies subjective and then objective sentences. Subjective sentences contain opinions, after identification of such sentences, they are further defined as positive, negative as well as neutral respectively.

C. Feature Level/ Aspect Based

It executes the fine-grained sentiment classification as well. In this method, the features of an entity or product are identified and sentiments for those features (aspect) of the product are determined. For determining sentiment of an aspect, opinion words related to that feature need to be extracted accurately. Here sentiments are aggregated for each aspect of the product [7], [8].

III. SENTIMENT ANALYSIS APPROACHES

Sentiment analysis task can be broadly categorized into Machine Learning (ML) techniques and lexicon-based approach.

A. Machine learning approach for sentiment analysis

The machine learning approach for sentiment classification mostly relies on supervised classification methods [3]. In this approach, training and testing data is used. Training data labeled with the class labels is used to train classifiers and test data is used to test the classification performance of a classifier. Machine learning approach for sentiment classification generally consist of following steps (i) Feature extraction from training data. In earlier work, features are mostly selected using a Bag of Word (BoW) approach. (ii) Feature selection: the machine learning approach requires specific and limited features set to train the classifier. Increased number of non-specific features, decreases the recital of a classifier. The size of the feature vector is reduced by extract as well as select specific features using feature selection techniques. (iii) Train the desired classifier with the help of the selected feature set. (iv) Test the performance of the classifier using the test dataset [10].

The algorithm in [10] used the ML-based approach to categorize the movie review as well as the product review dataset. In this study, the authors extracted four types of basic features; namely, unigrams, bigrams, bi-tagged, and dependency parsing tree-based terms vectors. Prominent



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Number papers in national/international conference-proceedings per teacher during the academic year 2019-20

Sr. No.	Name of the teacher	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / international	Year of publication	ISBN number of the proceeding	Affiliating Institute at the time of publication	Name of the publisher	Relevant link
1	S M M Naidu	A Review of Instrumentation Signal Processing and Applications of Brain Computer Interfacing	International Conference on Science Engineering and Technology (ICSET-2020)	International Conference on Science, Engineering and Technology (ICSET-2020)	International	Mar-20	0193-4120	Hope Foundation's International Institute of Information Technology, Pune	Institute for Engineering Research and Publication	

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Number of books and chapters in edited volumes / books published, and papers in national/international conference-proceedings per teacher during the academic year 2019-20

Sl. No.	Name of the teacher	Title of the book/chapters published	Year of publication	ISBN number of the proceeding	Affiliating Institute at the time of publication	Name of the publisher	Relavant link
1	Prof. Ashok N. Shinde	Modified meta-heuristic-oriented compressed sensing reconstruction algorithm for bio-signals	2019	2019 ISSN (print): 0219-6913 ISSN (online): 1793-690X	Dr. BATU Lonere	International Journal of Wavelets, Multiresolution and Information Processing (World Scientific Publishing Co Pvt Ltd)	https://www.worldscientific.com/doi/abs/10.1142/S0219691319500310

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This is to Certify that

Dr. S. M. M. Naidu of

Hope Foundation's, International Institute of Information Technology, Pune presented his/her research

paper titled *A Review of Instrumentation Signal Processing and Applications of Brain Computer Interfacing*

during the *connecting engineers...developing research*

"International Conference on Science, Engineering and Technology (ICSET-2020)" organized by Institute For Engineering Research and Publication (IFERP) held on 6th and 7th of March 2020 at Pune, Maharashtra.

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Detecting Potholes on Roads Using Accelerometer Available on Smartphones

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Abstract

Most countries in the world have poor road conditions because of unavailability of reliable road quality data and are hence unable to repair and maintain damaged roads. The objective of this paper is to develop a model to detect poor road quality and identify potholes on roads using data from accelerometers. The accelerometer readings from a smartphone mounted on a motorbike is used in this research. The location of potholes and poor-quality roads in general is noted prior to obtaining the readings. Potholes are detected by obtaining the difference of acceleration data with the mean acceleration in the vertical direction. The evaluation clearly shows that vertical acceleration can be used as a reliable indicator of road quality. Finally, GPS data from the smartphone is used to mark the locations of potholes on a map..

Keywords; Pothole detection, road quality, accelerometer, signal processing.

I. INTRODUCTION

Road transportation is a key element in the working of an economy as they facilitate the movement of people and goods. However, major urban areas around the globe have poor road quality due to overuse and lack of maintenance. Roads can deteriorate to the level where they become dangerous. This includes potholes, uneven road surfaces, broken concrete, exposed rebar, and road cracks. Uneven road surfaces can cause a driver to lose control of their vehicle, while a large pothole could burst the tyre of a vehicle. Furthermore, poor roads generally tend to slow down traffic. Dangerous road conditions can also cause loss of life.

Municipalities and other government agencies struggle to locate areas with bad road conditions and potholes. During the monsoon season, the water weakens the underlying soil, and the traffic passing over the road breaks the poorly supported bitumen

surface. The location of potholes on a road cannot be found out without an expensive survey.

The aim of this research is to detect potholes and uneven road surfaces using the accelerometer sensor available on a smartphone. By observing the variations in the acceleration, we aim to automatically detect potholes on a road surface, and then geo-tag it on a map using the GPS sensor on the smartphone. If done at scale, it would be possible for municipalities to obtain valuable information about potholes and poor road quality.

II. METHODOLOGY

2.1 Initial Survey

A small geographic area was chosen for this research. Initially, one road was surveyed, and the road quality was assessed. Some patches of the road were relatively smoother than the others. The location of potholes and minor bumps in the road were also noted during this survey. The length of the entire road traversed for this research is roughly

11644

Recent Trends in Power Quality Improvement and Demand Side Load Management in Smart Grids

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Abstract - - The growing consumer demand on electrical energy sources every day and the aging transmission and distribution power grid infrastructure is causing new challenges for electrical engineers. In recent years, the focus of power system engineers and consumers has been shifted to “power quality” due to increased usage of voltage sensitive equipment such as computers, servers, network infrastructure and precision electronic manufacturing equipment by consumers. The variations in bus voltage mainly occur due to electromagnetic transients, harmonic distortion, voltage sag, voltage swell and flicker due to switching of large capacitor banks in power grid. In addition, recently there have been numerous small to mid-size installations of renewable energy sources such as solar photovoltaic (PV) systems and wind power generation which are connected to the grid at the distribution side. The nature of these renewable energy sources is that they produce intermittent power generation based on solar and wind energy availability and their high penetration poses problems of voltage and frequency instability in the grid.

Another cause of poor power quality is that load demand is not predictable and consumption or daily behaviour of load patterns is not known, hence there is difficulty in matching the demand and supply of power. Demand side management helps energy providers to reduce the peak load demand and adjust the load profile to a certain extent. In this paper, several latest publications related to the improvement of power quality such as passive and active filters, Active Power Line Conditioning (APLC), static VAR compensation, electric spring and smart loads are reviewed. Also various methods of demand side management such as estimation of load patterns, peak clipping, valley filling, intelligent load switching, electric spring and smart loads for reducing the peak demand on utilities are discussed. Proposed work in this area includes development of new topologies and control methodologies of electric spring to get fast response to the changing load and maintain grid stability. Another area of proposed work includes development of algorithms for accurate estimation of demand load patterns so as to reduce the peak load demand on the system.

Keywords - - Smart grid, Electric spring, Active Power Line Conditioning (APLC), Smart loads, ICT

I. Introduction

In recent years, consumers are paying more attention to power quality due to increased usage of voltage sensitive equipment such as computers, power electronic motor drives, inverters and network infrastructure such as servers, routers, modems etc. Any power line interruption, frequency variation, transient noise can permanently damage the electronic equipment at the consumer end. If the consumer equipment is damaged, it can be concluded that power quality problem exists and it needs to be addressed immediately as the consumers can lose their business competitiveness and incur financial losses. [4].

The generation of power is distributed these days with small to mid-size installations of renewable energy sources such as solar photovoltaic (PV) systems and wind power generation systems at the distribution side. The nature of these renewable energy sources is that they produce intermittent power generation based on solar and wind energy availability during the day and their high penetration in utility grids is posing problems of voltage and frequency instability. Due to distributed nature of renewable energy sources, fast response to the user demand needs to be achieved in efficient manner and it is required to balance the demand and supply patterns more closely in order to maintain power and frequency stability and also to reduce voltage imbalance.

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