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A VARIOUS TECHNIQUES BASED ON UNDERWATER IMAGE ENHANCEMENT: A REVIEW

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Abstract— This review paper r manages a procedure of enhancing the nature of underwater image (UI). The nature of UI is poor because of the properties of water and its pollutions. The properties of water cause lessening of light goes through the water medium, bringing about low differentiation, obscure, inhomogeneous lighting, and color reducing of the UI. This paper proposes a strategy for improving the nature of underwater image. UI principally experience the ill effects of the issue of poor shading complexity and poor visibility. These issues happened because of the diffusing of light and refraction of light while entering from rarer to denser medium. Numerous systems and techniques are set up by specialists to take care of the issue of submerged picture improvement. In this paper diverse submerged picture upgrading systems are explored and considered. The general goal is to investigate the weaknesses in prior strategies.

Keywords—Underwater Image Enhancement; techniques; Application;Literature.

I. INTRODUCTION

Digital Image Processing (DIP) has distinctive methods to altering and enhancing the picture characteristics. Underwater images (UI) causes light scattering and shading impact are two noteworthy wellsprings of contortion for UI. Light disseminating brings down the visibility and differentiation of captured picture. Furthermore, shading change prompts the fluctuating degrees of lessening. The particles are sand, minerals, tiny fish and so forth. Are available in the water and ingestion of regular light, these diffusing influences a picture which is taken in submerged. As light reflected from items continues towards the camera, a segment of the light meets these suspended particles, which ingests and disseminates the light. [1]

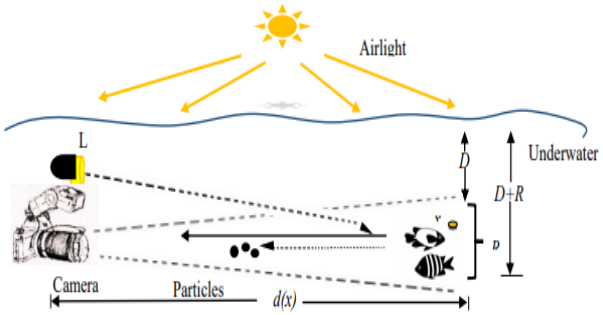

Fig-1: Underwater image

Underwater images (UI) are adulterated because of scrambles and amalgamation, bringing about low difference and shading mutilation. Captured UI experience the ill effects of poor visibility. It is difficult to procure noticeable pleasant pictures at long or short separations due to the absorptive and scattering nature of ocean water. Commotions decrease the points of interest that could contain huge data. Consequently, super-settling submerged spotted pictures are essential for sea perception. These pictures as often as possible experience the ill effects of shading contortion and low difference because of the proliferated light decrease with separation from the camera, for the most part coming about because of retention and disseminating impacts. Despite the fact that there are many picture improving strategies grew, for example, white equalization, shading rectification, HE, and combination based techniques, they are not based on a physical model underwater, and thus are not applicable for underwater images with different physical properties. It is trying to reestablish submerged pictures as a result of the deviation of physical properties. Light decrease submerged [2] prompts distinctive degrees of color change, contingent upon wavelength, broke down natural mixes, water saltiness, and centralization of phytoplankton.

II. UNDERWATER IMAGE ENHANCEMENT

Image enhancement is a procedure of enhancing the nature of picture by enhancing its element and its RGB esteems. The UIP territory includes got impressive consideration inside the most recent decades, demonstrating critical accomplishments. This paper has a review on some of the most recent methods that have been specifically developed for the underwater scenarios. These strategies are fit for expanding the scope of UIP, enhancing picture differentiate level and goals quality. After thought of the essential material science of the light proliferation in the water medium, we center around the diverse techniques accessible in the past articles. The situation for which all of them have been firstly developed are highlighted as well as the quality assessment methods used to evaluate their perform ance. A noteworthy trouble to process submerged pictures originates from light weakening, it restricts the perceivability remove, at around twenty meters in clear water and five meters or less in sloppy water. The light decrease process is caused by the assimilation (which evacuates light vitality) and spreading (which alters the course of light wave way). Assimilation of light and its disseminating impacts are a direct result of the water itself and to different segments, for example, broke up natural issue or little recognizable coasting particles. Because of this trouble, underwater imaging endures such a large number of issues [3]

III. APPLICATION

[3] This technique useful for several other applications and is discussed as follows-

Matching images by local feature points -
It is a most basic task of many visual applications of computer. The SIFT operator for an initial pair of UIs are employed. In the two cases, the use of unique SIFT is done similarly. It for the most part reestablishes both worldwide difference and neighborhood highlights of UIs.

Segmentation- Segmentation technique divides pictures on to disarticulate and undeviating realm along aspect to some characteristics (like- texture, color). This undertaking shows that our system does not acquaint radiances close with protest limits.

Image dehazing- It is a component of end of the cloudiness and mist impacts from the spoilt pictures. In view of connection limited by gray and underwater conditions in light of the fact that the light dispersing procedure, since the underwater light proliferation is more intricate that picture dehazing could be viewed as a subclass of the UI rebuilding issue. [4]

IV. DIFFERENT TECHNIQUES FOR UNDERWATER IMAGE ENHANCEMENT

1. Contrast stretching- It is a direct picture upgrade strategy that is utilized to enhance, improve the picture differentiate by `stretching' the arrangement of force esteems. A proportion of picture's dynamic range or the "broaden" of picture's histogram is the difference of a picture. Entire scope of force esteems present inside the picture, or in a simpler way, the base pixel esteem subtracted from the most extreme pixel esteem is called dynamic scope of picture. It contrasts from the more muddled HE out in a way that it can just concern a direct scaling capacity to the picture pixel esteems.

2. Empirical Mode Decomposition (EMD)- EMD is a flexible and dependent on the nearby minute time frame capacity of the figures [9]. In this way, it is reasonable to help nonlinear alongside non-stationary information so it is an amazingly proficient adept opportunity for real-life software.. The EMD technique is uncommonly immediate, and the essential system is to do sifter activities on the new information game plans until the point when the last information arrangement are stationary, and hence break down the entire flag into numerous Intrinsic Mode Functions (IMFs) and a buildup. EMD is associated with the RGB channels freely. The first picture is separate into a few characteristic mode works by EMD process and a last buildup.

3. Homomorphic filtering (HF) The HF is used to settle non-uniform lighting to fortify complexity from the impression. This is a recurrence separating system. It is the most used framework in light of the fact that it reviews non-uniform lighting and hones the photo.

$$F(x, y) = I(x, y)^{*}r(x, y)$$

Where F(x, y) is the function of image detected by device, I(x, y) the illumination function and r(x, y) the reflectance function. By multiplying these components filter can decrease the non consistent explanation present in the picture.

4. Anisotropic filtering It disentangles picture segments to upgrade picture division. This diverts smoothes the photo in homogeneous range anyway moderate edges and redesigns them. It is used to smooth organizations and decreases relics by deleting little edges upgraded by homomorphic filtering.

5. Wavelet denoising by average filter Wavelet denoising is used to stifle the noise i.e the Gaussian clamor (GN) are ordinarily present in the camera pictures and other sort of instrument pictures. While moving the photos GN can be incorporated. These wavelet denoising gives awesome outcomes diverged from other denoising schedules in light of the fact that, in contrast to different strategies, it doesn't expect that the coefficients are free. Without a doubt wavelet coefficients in typical pictures have tremendous conditions. Other than the retribution time is short.

6. Red channel method In this strategy, hues related to short wavelengths are recuperated, obviously for submerged pictures, prompting a recuperation of the lost difference [10]. The main thing in this technique to gauge is the shade of the water. Pick a pixel that lies at the most extreme profundity concerning the camera. It is accepted that corruption of picture relies on area of pixel. In the wake of assessing the water light transmission of the scene is evaluated. At that point Color rectification is finished.

7. Histogram equalization (HE) It is a technique for altering picture forces and complexity of picture in picture handling utilizing the picture's histogram. HE is useful in pictures with foundations and frontal territories that are both brilliant and both gray. This is a basic and direct strategy. In any case, it has a burden additionally that is it likewise increases the foundation commotion present in the picture and prompt decline in the valuable flag. So it produces doubtful impacts in the yield pictures. The essential thought lying behind this strategy is mapping the dim levels relying on the likelihood dissemination of the information dark levels.

8. Contrast Limited Adaptive Histogram Equalization (CLAHE) It is simplification of AHE. With this method the picture is broken up into tiles. The gray scale is calculated for each of these tiles, based upon its histogram and transform function, which is derived from the interpolation between the manipulated histograms of the neighboring sub-locales. The change work is in respect to the cumulative distribution function (CDF) of pixel esteems in the zone. CLAHE contrasts from AHE interestingly constraining. CLAHE limits the clamor improvement by cut-out the histogram at a customer described worth.

A. CLAHE on RGB color model it is an added substance shading model which portrays tones with respect to the proportion of red (R), green (G) and blue (B) present. It portrays what kind of light should be transmitted to make a given shades present in the picture. CLAHE can be material to all the three sections ie. red, green and blue independently. The impact of full-shading RGB can be obtained by consolidating the individual parts of model.

B. CLAHE on HSV color model it is defines colors in terms of the Hue (H), Saturation (S), and Value (V). HSV shading model is round and hollow facilitate representation of focuses in a RGB shading model. Tint is the normal for a visual sensation as demonstrated by which a region is by all accounts identified with one of the shading seen. The shade and immersion level don't have any sort of impact when esteem is at max or min power level. CLAHE is connected on V and S parts [5].

9. Integrated color model it is essentially settled on shading fitting by differentiation change is RGB shading space and shading modification in HSI model. In integrated color model first step is to diminish the color cast by the equalization of all the color values present. In the second step a change is connected to the complexity correction to expand the histogram estimations of the red shading. Second step is again improved the situation green and blue hues. In the last advance of the model, the immersion and force segments of the HSI shading model is pertinent for difference change in accordance with improve the real nature and for managing the issue of uneven light.

V. LITRATURE SURVEY

H. Kaplan et al. [2017] in this examination, an improvement strategy in light of bilateral filtering is proposed. We propose to extricate the subtle elements of the picture by a multiscale bilateral filtering and add these points of interest to the first picture utilizing a weighting plan. Visual outcomes and assessment measurements demonstrate that the proposed strategy, improve the picture superior to anything the previous strategies while it better than the 1stcolor information [6].

Silviu-IoanBejinariu et al. [2017] in this paper a photo separate change strategy in perspective of multiobjective headway is proposed. The differentiation pick up which must be amplified and tone contortion which must be limited are utilized as streamlining criteria. Since the histogram advancement is a high-dimensional issue, as improvement calculation the use of nature-propelled heuristics is proposed. Especially, inside the analyses provided on this paper, the PSO set of guidelines is utilized. Our differentiation upgrade strategy ends up being better than customary procedures like HE regarding contrast pick up and tone mutilation, the two criteria being improved [7].

Su-Ling Lee et al. [2017] in this paper, a color picture upgrade technique is introduced by utilizing power HE approach without changing tint and immersion in HSI shading space. The proposed technique has preferable visual beauty over the ordinary HE strategy since tint and immersion are saved in the upgrade procedure. The backdrop illumination picture and evening time picture are utilized to exhibit the viability of the proposed color improvement technique [8].

Bo-Hao et al. [2017] In this paper, our propose another HE-based calculation that enhancement picture differentiate in view of a suspicion of greatest entropy to keep up different highlights of picture quality. The exploratory outcomes check that our proposed calculation is ideal for creating improved pictures, as per both quantitative estimation and subjective human visual investigation [9].

Zhou Zhao et al. [2017] In this paper our propose another picture differentiate enhancement calculation. It implants PLIP operations directly into a solid histogram revision structure. Trial impacts demonstrate that the proposed set of guidelines can proficiently brighten picture assessment in the meantime as ceasing extreme upgrade [10].

Mohammed Alareqi, et.al This paper introduces the plan and the usage of ongoing equipment upgrade DIP strategies for biomedical applications in a spatial space on FPGA. It explains numerous enhancement strategies consisting of inverting picture operation, brightness manipulate, segmentation (threshold) and evaluation stretching. These techniques

are applied to the hand picture with veins using Open Access Biomedical picture Search Engine. The cause of this paintings is to achieve a real-time hardware implementation with higher execution in each length and pace. [11]
Amjad Khan (2016) et al present that Most of the underwater image (UI) include a layer of haze, fashioned via suspended debris in the turbid water that create scattering and absorption of light. Absorption limits the visibility because of light attenuation at the same time as scattering blurs the photo functions, in the long run the UI captured through the camera in such a medium, are dim and debased when contrasted with the ordinary pictures taken in the environment. In this paper, we are proposing a wavelet-based combination strategy to improve and dehaze the submerged cloudy pictures of consumed pipeline. The most important purpose of these studies is to check out the underwater pipelines for the corrosion estimation. There are three foremost tiers in the proposed technique. At the initial stage, the hazy underwater photo of corroded pipeline is more suitable with the aid of adjusting its contrast and the shade profiles. In the second one phase, the wavelet-based decay and backwards organization are done to combine the enhanced varieties directly into a dehazed picture. At the last stage, the erosion on the surface of the pipeline is assessed.In order to validate the performance, the corrosion is estimated in both hazy and dehazed image [12].

Daily Daleno de O. Rodrigues (2016) et al presents that The demand for efficient enhancement methods of UIof the rivers in the Amazon region is increasing. However, most of those in the region present moderate turbidity and low luminosity. This work plans to enhance these pictures by non-straight separating procedures, which advance the minimization of light collaboration attributes with the earth, loss of the contrast and colors. The proposed method is compared with two others techniques that require a unique image as input. The results of the proposed method is promising, with better visual quality considering a wide range of experiments with simulation data and real outdoor scenes [13].

Yaomin Wang (2016) et al present that submerged IE is a standout amongst the most basic and key errands in sea examinations ongoing years. In this paper, we made an attempt to increase one adaptive underwater IE approach with the help of the digital retina version and the imaginary quality assessment (IQA). The virtual retina model, which yields comparatively excessive correlation with the human imaginative and prescient device, is first taken to acquire simultaneous ambiguity eliminating and element improving of single image because of the precise mechanisms of different retinal sub-layers. After this, an adaptive IE method is inquisitive about one kind of no-reference image first-class assessment primarily based Patch Discrete Cosine Transform (PDCT), that mention whether the image patches are naturally uniform or not. Its appeared inside the reenactment test that the proposed methodology ought to harvest incredible exhibitions in both heartiness and viability, with great practices in the vision impacts and exactness for the UI[14].

Yujie li, et.Al.(2015) In this paper, our propose a novel shallow water imaging rendition to give penance for the constriction disparity close by the engendering heading and a viable underwater scene enhancement device. The recovered pictures are characterized by using a diminished noised degree, better exposure of the darkish areas, and elevated world contrast the place the best small print and edges are more advantageous drastically.[15]

Tarun Kumar Agarwal, et.al. (2015) Stated that IE is very stimulating and visually attractive regions of IP. It includes processes for example increasing contrast, decreasing noise for enhancing the picture quality. This paper offers study of the arithmetical morphological scheme with contrast to many other state-of-art methods for addressing the difficulties of low pictures contrast. HE is very general method for enhancing contrast in DI. It is modest and effective for GCE of pictures.[16]

C.Narasimha,et.al (2015) IP is required before the image can be utilized. Denoising the pictures holds the operation of the records of picture to yields a visually excessive pleasant picture. The primary attention of this paper is, it provides the styles of noise models, distinct varieties of noises and differentiating of IE techniques. Here we give a similar report and investigation of various IE algorithms.[17]

Nidhi Chahal,et.al (2015) In the provided paper, fIrst phase gives a quick advent to the IE, the second one section carries a short literature approximately the previous work done and the 1/3 section carries proposed trouble and associated proposed technique to decorate the picture. The proposed device works via tracking the edges the usage of ICA and PCA primarily based tIltering by using firstly remodeling the image into HSV domain after which applying the filtering and differentiation change, after that the picture is again changed over to visible form and dissected under PSNR, MSE and Standard Deviation.[18]

Swati D. Nikam,et.al (2015) To enhance the noisy pictures diverse IE techniques are used and those strategies can gives better results than the original corrupted picture. In this paper WT is used for shade IE. The proposed technique enhances the contrast and luminance in addition to eliminate the noise in the shade picture. In this planned process daubechies WT and HIS color space used.[19]

Rajlaxmi Chouhan, et.al (2014) This paper provides a noise-aided IE algorithm targeted on addressing pictures which have a huge dynamic range, i.e., pictures with both dark and vivid areas. The software of a brand new mathematical

version, in a shifted double-well machine showing stochastic resonance, is investigated for such pictures. The new numerical model tends to the deficiencies of prior SR fundamentally based upgrade variant with the guide of getting parameters basically from info esteems (in inclination to enter records. [20].

TABLE I. COMPARATIVE TABLE I ADVANTAGES AND DISADVANTAGES OF UNDERWATER IE TECHNIQUE [21,22]

Techniques	**Advantages**	**Disadvantages**
Point Processing operation	Can only be used for linear stretching	Cannot produce much attractive results in many cases
Histogram equalization (HE)	This approach is quality for visible belief especially when imaginary have near evaluation data, produces best result for radiographic and thermal pictures.	This technique results in noise amplification when the images have major low intensity area.
Low Pass Filter (LPF)	LPF is good for disposing of a small quantity of excessive frequency noise from an N dimensional signal [21].	It suffers from two problems: Blurring and Ringing caused due to undulation associated with spatial domain (SD) filter.
High Pass Filter (HPF)	HPF is better for removing a minor amount of lowest frequency noise from an N dimensional signal	This filter out is handiest a primary-order clear out, it is able to no longer provide you with a step sufficient cutoff frequency for the application you want.
Holomorphic Filter	utilized to delete additive and multiplicative noise	Reflectance and Illumination are not separable.
LAHE	Offers an terrific enhancement of picture evaluation.	Computationally very slow, calls for a excessive range of operations in line with pixel. Of operations consistent with pixel.
Cumulative HE	Has better performance in HE.	Needs a some more operations due its necessary to make the cumulative histogram.
Par Sectioning	Simply to implement.	Good suited to hardware implementation.
Odd Sectioning	Offers better image contrast.	Have issue with histograms that cover almost the full gray scale.

Adaptive Histogram Equalization (AHE)	It encompasses lowest contrast and dark area.	Won't work effectively.
Décor relation Stretch	Its originated in the world satellite and aerial mapping.	Its a much complicated procedure then the another defined site.
Image Adjust	It's utilized to adjust the image intensity at simply.	Not able to search the original image.
Image Noise	Its utilized to decrease the noise from an imaginary simple [22].	While the dispensable image in lowest light.

Conclusion

Underwater image enhancement (UIH) methods give an approach to enhancing the property or protest distinguishing proof in underwater condition. There is part of research began for enhancing the nature of underwater image (UI), however restricted work has been done in the region of UI. In this paper diverse UIH procedures are surveyed and contemplated. All the explored strategies upgrade the UI to great extent. The problem of the uneven light brightening is similarly ignored by far most of the researchers. The writing review uncovers that picture based preprocessing calculations utilizes standard filter strategies with different blends. For smoothing the picture, the picture based preprocessing calculations utilizes the anisotropic filter. The fundamental disadvantage of the anisotropic filter is that iterative in nature and calculation time is high contrasted with bilateral filter. In addition to other three filters, we employ a bilateral filter for smoothing the image. This paper concludes with the certain limitation of existing techniques. The future work will include further evaluation of the enhancement techniques.

References

[1] P.Swetha1 , Dr.R.Maruthi2, "A Survey on Underwater Image Enhancement Techniques". International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 6, Special Issue 11, September 2017

[2] K. Natarajan, "A REVIEW ON UNDERWATER IMAGE ENHANCEMENT TECHNIQUES". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 04 | Apr -2017

[3] Pooja Sahu, Neelesh Gupta, Neetu Sharma, "A Survey on Underwater Image Enhancement Techniques". International Journal of Computer Applications (0975 – 8887) Volume 87 – No.13, February 2014

[4] Cosmin Ancuti, Codruta Orniana Ancuti, Tom Haber and Philippe Bekaert,"Enhancing Underwater Images and Videos by Fusion",978-1-4673-1228

[5] Sonam Bharal, GNDU Amritsar, "A SURVEY ON VARIOUS UNDERWATER IMAGE ENHANCEMENT TECHNIQUES". International Journal of Computer Application (2250-1797) Volume 5– No. 4, June2015

[6] N. H. Kaplan, I. Erer vand N. Gulmus "Remote Sensing Image Enhancement via Bilateral Filtering"2017 IEEE.

[7] Silviu-Ioan Bejinariu, Hariton Costin, Senior Member, IEEE, Florin Rotaru1 , Ramona Luca1 , Cristina Niţă1 , Diana Costin3 "Image Enhancement by Multiobjective Optimization and Bio-inspired Heuristics" June 22-24, 2017 IEEE.

[8] Su-Ling Lee and Chien-Cheng Tseng "Color Image Enhancement Using Histogram Equalization Method without Changing Hue and Saturation" 2017 IEEE International Conference on Consumer Electronics - Taiwan (ICCE-TW)

[9] Bo-Hao Chen and Yu-Ling Wu "An Entropy-Preserving Histogram Modification Algorithm for Image Contrast Enhancement" Proceedings of the 2017 IEEE International Conference on Applied System Innovation IEEE-ICASI 2017.

[10] Zhou Zhao, Yicong Zhou "An Image Contrast Enhancement Algorithm Using PLIP-based Histogram Modification" 978-1-5386-2201-8/17/$31.00 ©2017 IEEE.

[11] Mohammed Alareqi, R. Elgouri, M. Tarhda, K. Mateur, A., "Design and FPGA Implementation of Real-Time Hardware Co-Simulation for Image Enhancement in Biomedical Applications". 978-1-5090-6681-0/17/$31.00 ©2017 IEEE

[12] Amjad Khan, Fabrice Meriaudeau, Syed Saad Azhar Ali and Aamir Saeed Malik," Underwater Image Enhancement and Dehazing Using Wavelet Based Fusion for Pipeline Corrosion Inspection",2016 IEEE.

[13] Daily Daleno de O. Rodrigues, Wagner F. de Barros, Jose P. de Queiroz-Neto , Anderson G. Fontoura and Jose Reginaldo H. Carvalho," Enhancement of Underwater Images in Low-to-High Turbidity Rivers", 2016 29th SIBGRAPI Conference on Graphics, Patterns and Images

[14] Yaomin Wang, Ruijie Chang, RuiNian, Bo He, Xunfei Liu, Jen-Hwa Guo and Amaury Lendasse," Underwater Image Enhancement Strategy with Virtual Retina Model and Image Quality Assessment", 2016 IEEE.

[15] Yujie li, huimin lu, jianru li, xin li, seiichi, serikawa, "underwater image enhancement using inherent optical properties". Ieee 2015

[16] Tarun Kumar Agarwal, Mayank Tiwari, Subir Singh Lamba, "Modified Histogram Based Contrast Enhancementusing Homomorphic Filtering for Medical Images".IEEE 2015

[17] C.Narasimha, Dr.A.Nagaraja Rao, "A Comparative Study: Spatial Domain Filter for Medical Image Enhancement". 2015

[18] N idhi Chahal, Sakshi Shanna, "Image Enhancement Using Combined ICA and PCA Based Filtering in HSV Domain". 978-1-5090-0148-4/15/$31.00© 2015 IEEE

[19] Swati D. Nikam, Rajesh U. Yawale, "Color Image Enhancement Using Daubechies Wavelet Transform And HIS Color Model". 978-1-4799-7165-7/15/$31.00 ©2015 IEEE

[20] Rajlaxmi Chouhan and Prabir Kumar Biswas, "IMAGE ENHANCEMENT AND DYNAMIC RANGE COMPRESSION USING NOVEL INTENSITY-SPECIFIC STOCHASTIC RESONANCE-BASED PARAMETRIC IMAGE ENHANCEMENT MODEL". 978-1-4799-5751-4/14/$31.00 ©2014 IEEE

[21] Pinki Agrawal 1, Vishakha Chourasia 2,Ravikant Kapoor 3, Sanjay Agrawal 4," A Comprehensive Study of the Image Enhancement Techniques.", International Journal of Advance Foundation and Research in Computer (IJAFRC) Volume 1, Issue 7, July 2014, pp:84-89.
M.Aarthy1 , P.Sumathy2," A COMPARISON OF HISTOGRAM EQUALIZATION METHOD AND HISTOGRAM EXPANSION", International Journal of Computer Science and Mobile Applications, Vol.2 Issue. 3, March- 2014, pg. 25-34