Eurasian Journal of Analytical Chemistry
ISSN: 1306-3057 OPEN ACCESS 2017 12 (3): 110-116

Data Embedding Method Using Adaptive Pixel Pair Matching Method

M. Jasmin, Dr.M. Sundararajan, M. Susila

Received: 08 November 2016 ▪ Revised: 11 December 2016 ▪ Accepted: 10 January 2017

Abstract: This paper proposes a new data-hiding method based on Adaptive pixel pair matching (APPM). The basic idea of APPM is to use the values of pixel pair as a reference coordinate, and search a coordinate in the neighborhood set of this pixel pair according to a given message digit. The pixel pair is then replaced by the searched coordinate to conceal the digit. The proposed method offers lower distortion than data embedding by providing more compact neighborhood sets and allowing embedded digits in any notational system. Compared with the optimal pixel adjustment process (OPAP) method, the proposed method always has lower distortion for various payloads. Experimental results reveal that the proposed method not only provides better performance than those of OPAP, but also is secure under the detection of some well-known techniques.

Keywords: Adaptive Pixel Pair Matching (APPM), Optimal Pixel Adjustment Process (OPAP), LSB-planes.

INTRODUCTION

Adaptive Pixel Pair Matching method (APPM) in images is a technique, by which the original cover can be losslessly recovered after the embedded message is extracted. This important technique is widely used in medical imagery, military imagery and law forensics, where no distortion of the original cover is allowed. Since first introduced, APPM has attracted considerable research interest. In theoretical aspect, Kalker and Willems established a rate-distortion model for APPM, through which they proved the rate-distortion bounds of APPM for memory less covers and proposed a recursive code construction which, however, does not approach the bound. Zhang improved the recursive code construction for binary covers and proved that this construction can achieve the rate-distortion bound as long as the compression algorithm reaches entropy, which establishes the equivalence between data compression and APPM for binary covers. In practical aspect, many APPM techniques have emerged in recent years. Frid rich constructed a general framework for APPM. By first extracting compressible features of original cover and then compressing them losslessly, spare space can be saved for embedding auxiliary data. A more popular method is based on difference expansion (DE), in which the difference of each pixel group is expanded, multiplied by 2, and thus the least significant bits (LSBs) of the difference are all-zero and can be used for embedding messages. Another promising strategy for APPM is histogram shift (HS), in which space is saved for data embedding by shifting the bins of histogram of gray values. The state-of-art methods usually combined DE or HS to residuals of the image, e.g., the predicted errors, to achieve better performance. There are two technical challenges which exist in H-bridge cascaded STATCOM to date. First, the control method for the current loop is an important factor influencing the compensation performance. However, many non-ideal factors, such as the limited bandwidth of the output current loop, the time delay induced by the signal detecting circuit, and the reference command current generation process, will deteriorate the compensation effect.

An adaptive control and linear robust control have been reported for their anti-external disturbance ability. A popular dead-beat current controller is used. This control method has the high band width and the fast reference current tracking speed. The steady-state performance of H-bridge cascaded STATCOM is improved.

M. Jasmin, Assistant Professor, Department of Electronics and Communication Engineering, BIST, BIHER, Bharath Institute of Higher, Education & Research, Selaiyur, Chennai. E-mail: jasmin.ece@bharathuniv.ac.in

Dr.M. Sundararajan, Professor, Department of Electronics and Communication Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai.

M. Susila, Assistant Professor, Department of Electronics and Communication Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai.

OBJECTIVE OF THE PROJECT WORK

Recently, more and more attention is paid to reversible data hiding (APPM) in encrypted images, since it maintains the excellent property that the original cover can be losslessly recovered after embedded data is extracted while protecting the image content's confidentiality. All previous methods embed data by reversibly vacating room from the encrypted images, which may be subject to some errors on data extraction and/or image restoration. In this paper, we propose a novel method by reserving room before encryption with a traditional APPM algorithm, and thus it is easy for the data hider to reversibly embed data in the encrypted image. The proposed method can achieve real reversibility, that is, data extraction and image recovery are free of any error. Experiments show that this novel method can embed more than 10 times as large payloads for the same image quality as the previous methods, such as for PSNR =40 dB.

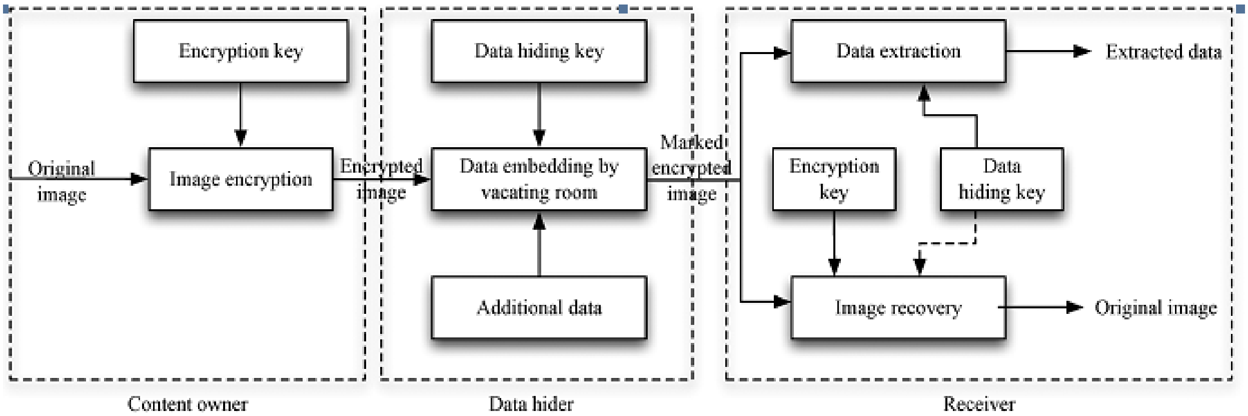
EXISTING SYSTEM

In this framework, a content owner encrypts the original image using a standard cipher with an encryption key. After producing the encrypted image, the content owner hands over it to a data hider (e.g., a database manager) and the data hider can embed some auxiliary data into the encrypted image by losslessly vacating some room according to a data hiding key. Then a receiver, maybe the content owner himself or an authorized third party can extract the embedded data with the data hiding key and further recover the original image from the encrypted version according to the encryption key.

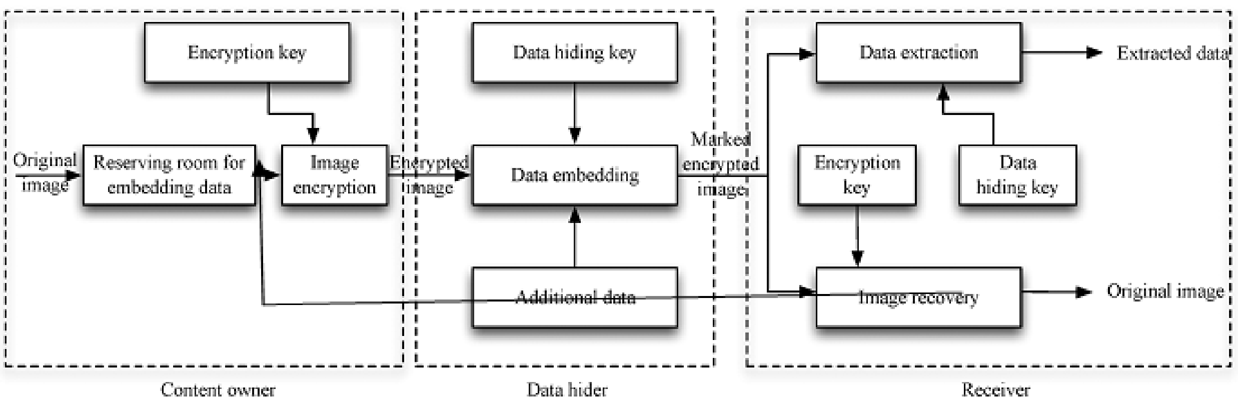
PROPOSED SYSTEM

In the present paper, we propose a novel method for APPM in encrypted images, for which we do not "vacate room after encryption" as done, but "reserve room before encryption". In the proposed method, we first empty out room by embedding LSBs of some pixels into other pixels with a traditional APPM method and then encrypt the image, so the positions of these LSBs in the encrypted image can be used to embed data. Not only does the proposed method separate data extraction from image decryption but also achieves excellent performance. Reserving room prior to image encryption at content owner side, the APPM tasks in encrypted images would be more natural and much easier which leads us to the novel framework, "reserving room before encryption (RRBE)".

PROPOSED SYSTEM BLOCK DIAGRAM



(a)



Block diagram of the proposed system

MODULE DESCRIPTION

In this framework, a content owner encrypts the original image using a standard cipher with an encryption key. After producing the encrypted image, the content owner hands over it to a data hider and the data hider can embed some auxiliary data into the encrypted image by losslessly vacating some room according to a data hiding key. Then a receiver, maybe the content owner himself or an authorized third party can extract the embedded data with the data hiding key and further recover the original image from the encrypted version according to the encryption key.

The content owner first reserves enough space on original image and then converts the image into its encrypted version with the encryption key. Now, the data embed ding process in encrypted images is inherently reversible for the data hider only needs to accommodate data into the spare space previous emptied out. The data extraction and image recovery are identical to that of Framework VRAE. Obviously, standard APPM algorithms are the ideal operator for reserving room before encryption and can be easily applied to Framework RRBE to achieve better performance compared with techniques from Framework VRAE. This is because in this new framework, we follow the customary idea that first losslessly compresses the redundant image content (e.g., using excellent APPM techniques) and then encrypts it with respect to protecting privacy.

Generation of Encrypted Image

The operator here for reserving room before encryption is a standard APPM technique, so the goal of image partition is to construct a smoother area , on which standard APPM algorithms. The above discussion implicitly relies on the fact that only single LSB-plane A of is recorded. It is straightforward that the content owner can also embed two or more LSB-planes A of into B, which leads to half, or more than half, reduction in size of . However, the performance of , in terms of PSNR, after data embedding in the second stage decreases significantlywith growing bit-planes exploited.

Image Encryption

The same with other APPM algorithms, overflow/underflow problem occurs when natural boundary pixels change from 255 to 256 or from 0 to -1. To avoid it, we only embed data into estimating error with its corresponding pixel valued from 1 to 254. However, ambiguities still arise when nonboundary pixels are changed from 1 to 0 or from 254 to 255 during the embedding process. These created boundary pixels in the embedding process are defined as pseudo-boundary pixels. Hence, a boundary map is introduced to tell whether boundary pixels in marked image are natural or pseudo in extracting process. It is a binary sequence with bit “0” for natural boundary pixel, bit “1” for pseudo-boundary pixel. Since estimating errors of marginal area of B cannot be calculated to make the best use of B we choose its marginal area to place the boundary map, and use B LSB replacement to embed it. The original LSBs of marginal area is assembled with messages, i.e., LSB-planes of , and reversibly embedded into. In most cases, even with a large embedding rate, the length of boundary map is very short; thus, the marginal area of B is enough to accommodate it.

Self-Reversible Embedding

The goal of self-reversible embedding is to embed the LSB-planes of A into B by employing traditional APPM algorithms For illustration, we simplify the method in to demonstrate the process of self-embedding. Note that this step does not rely on any specific APPM algorithm.

Extracting Data From Encrypted Images

To manage and update personal information of images which are encrypted for protecting clients’ privacy, an inferior database manager may only get access to the data hiding key and have to manipulate data in encrypted domain. The order of data extraction before image decryption guarantees the feasibility of our work.

Extracting Data From Decrypted Images

Inboth embedding and extraction of the data are manipulated in encrypted domain. On the other hand, there is a different situation that the user wants to decrypt the image first and extracts the data from the decrypted image when it is needed. The following example is an application for such scenario.

RESULTS

Figure 1 shows the experimental outcome for encoding process of data hiding using APPM.

Figure 2 shows the experimental Outcome for decoding process of data hiding using APPM.

Figure 1: Experimental outcome -Encoding process

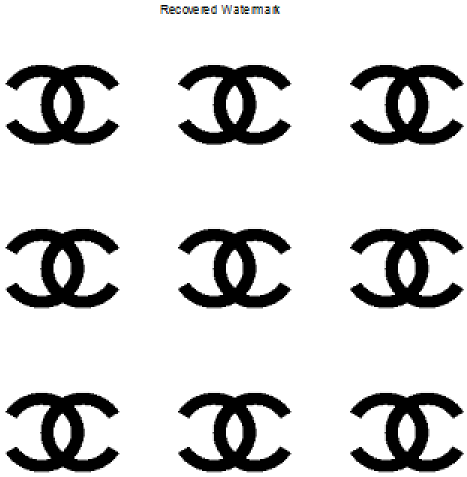


Figure 2: Experimental outcome – Decoding Process

CONCLUSION

APPM data hiding in encrypted images is a new topic drawing attention because of the privacy-preserving requirements from cloud data management. Previous methods implement APPM in encrypted images by vacating room after encryption, as opposed to which we proposed by reserving room before encryption. Thus the data hider can benefit from the extra space emptied out in previous stage to make data hiding process effortless. The proposed method can take advantage of all traditional APPM techniques for plain images and achieve excellent performance without loss of perfect secrecy. Furthermore, this novel method can achieve real reversibility, separate data extraction and greatly improvement on the quality of marked decrypted images.

References

[1] Sindhu, N., & Archana, M. (2015). Analysis of a Double-Tail Comparator for Low-Power Applications. *International Journal of Advances in Engineering and Emerging Technology, 7*(3), 102-121.

[2] Nageswaran, M.K. (2014). Improved Security in Mobile ADHOC Networks by Enhancing the Security of Pro-Active Protocols. *Excel International Journal of Technology, Engineering and Management, 1*(2), 46-50.

[3] S. Anitha and Dr.C.P. Chandran, (2016). Review on Analysis of Gene Expression Data Using Biclustering Approaches. *Bonfring International Journal of Data Mining, 6*(2), 16-23.

[4] Kondori, M.A.P., & Peashdad, M.H. (2015). Analysis of challenges and solutions in cloud computing security. *International Academic Journal of Innovative Research, 2*(5), 1-11.

[5] Ananth, C., Rajavel, S.E., Annadurai, I., Mydeen, A., Sudalai, C., & Kingston, M.R. (2014). Faq-Mast TCP for Secure Download. *International Journal of Communication and Computer Technologies, 2*(1), 47-55.

[6] Han, S.R., & Noah, M. (2017). Android Mobile Guardian System Security Architecture for Handset and Data Security. *Bonfring International Journal of Industrial Engineering and Management Science, 7*(1), 25-28.

[7] Umamaheswari, T.S., & Dr.Sumathi, P. (2018). Review of Gene Selection and Prediction Using Data Mining Methods*. Journal of Computational Information Systems, 14*(4), 114 - 121.

[8] Dr.Gomathi, P.M. and Dr.Karthika, D. (2018). Hybrid Adaptive Neuro-Fuzzy Inference System-Runge-Kutta Classification and Extracted the Eye Movement Features*. Journal of Computational Information Systems, 14*(4), 132 - 143.

[9] Sumathi, M., & Dr.Thilagavathy, N. (2018). Analysis of ICT Services in Smart Libraries*. Journal of Computational Information Systems, 14*(4), 159 - 163.

[10] Sadeghi, M. (2015). Improving the GPU performance prediction models to design space exploration. *International Academic Journal of Science and Engineering, 2*(6), 1-16.

[11] Krishnamoorthy P., & Jayalakshmi T. (2012). Preparation, characterization and synthesis of silver nanoparticles by using phyllanthusniruri for the antimicrobial activity and cytotoxic effects, *Journal of Chemical and Pharmaceutical Research, 4*(11), 4783-4794.

[12] Amir, M., Gungunes, H., Slimani, Y., Tashkandi, N., El Sayed, H.S., Aldakheel, F., Sertkol, M., Sozeri H., Manikandan A., Ercan, I., & Baykal, A. (2019). Mössbauer studies and magnetic properties of cubic CuFe 2 O 4 nanoparticles. *Journal of Superconductivity and Novel Magnetism*, *32*(3), 557-564.

[13] Raj M.S., Saravanan T., & Srinivasan V. (2014). A modified direct torque control of induction motor using space vector modulation technique. *Middle - East Journal of Scientific Research, 20*(11), 1572-1574.

[14] Khanaa, V., & Thooyamani, K.P. (2013). Using triangular shaped stepped impedance resonators design of compact microstrip quad-band. *Middle-East Journal of Scientific Research*, *18*(12), 1842-1844.

[15] Asiri S., Sertkol M., Güngüneş H., Amir M., Manikandan A., Ercan I., & Baykal A. (2018). The Temperature Effect on Magnetic Properties of NiFe 2 O 4 Nanoparticles. *Journal of Inorganic and Organometallic Polymers and Materials, 28*(4), 1587-1597.

[16] Thaya, R., Malaikozhundan, B., Vijayakumar, S., Sivakamavalli, J., Jeyasekar, R., Shanthi, S., Vaseeharan, B., Ramasamy, P., & Sonawane, A. (2016). Chitosan coated Ag/ZnO nanocomposite and their antibiofilm, antifungal and cytotoxic effects on murine macrophages. *Microbial pathogenesis*, *100*, 124-132.

[17] Kolanthai, E., Ganesan, K., Epple, M., & Kalkura, S.N. (2016). Synthesis of nanosized hydroxyapatite/agarose powders for bone filler and drug delivery application. *Materials Today Communications*, *8*, 31-40.

[18] Thilagavathi, P., Manikandan, A., Sujatha, S., Jaganathan, S.K., & Arul Antony, S. (2016). Sol–Gel Synthesis and Characterization Studies of NiMoO4 Nanostructures for Photocatalytic Degradation of Methylene Blue Dye. *Nanoscience and Nanotechnology Letters*, *8*(5), 438-443.

[19] Thamotharan C., Prabhakar S., Vanangamudi S., & Anbazhagan R. (2014). Anti-lock braking system in two wheelers. *Middle - East Journal of Scientific Research, 20*(12), 2274-2278.

[20] Thamotharan C., Prabhakar S., Vanangamudi S., Anbazhagan R., & Coomarasamy C. (2014). Hydraulic rear drum brake system in two wheeler. *Middle - East Journal of Scientific Research, 20*(12), 1826-1833.

[21] Vanangamudi S., Prabhakar S., Thamotharan C., & Anbazhagan R. (2014). Collision control system in cars. *Middle - East Journal of Scientific Research, 20*(12), 1799-1809.

[22] Vanangamudi S., Prabhakar S., Thamotharan C., & Anbazhagan R. (2014). Drive shaft mechanism in motor cycle. *Middle - East Journal of Scientific Research, 20*(12), 1810-1815.

[23] Anbazhagan R., Prabhakar S., Vanangamudi S., & Thamotharan C. (2014). Electromagnetic engine. *Middle - East Journal of Scientific Research, 20*(3), 385-387, 2014.

[24] Kalaiselvi, V.S., Prabhu, K., & Mani Ramesh, V.V. (2013). The association of serum osteocalcin with the bone mineral density in post-menopausal women. *Journal of clinical and diagnostic research: JCDR*, *7*(5), 814-816.

[25] Kalaiselvi, V.S., Saikumar, P., & Prabhu, K. (2012). The anti mullerian hormone-a novel marker for assessing the ovarian reserve in women with regular menstrual cycles. *Journal of clinical and diagnostic research: JCDR*, *6*(10), 1636-1639.

[26] Arul, K.T, Manikandan, E., Ladchumananandasivam, R., & Maaza, M. (2016). Novel polyvinyl alcohol polymer based nanostructure with ferrites co-doped with nickel and cobalt ions for magneto-sensor application. *Polymer International*, *65*(12), 1482-1485.

[27] Das, M.P., & Kumar, S. (2015). An approach to low-density polyethylene biodegradation by Bacillus amyloliquefaciens. *3 Biotech*, *5*(1), 81-86.

[28] Vanangamudi S., Prabhakar S., Thamotharan C., & Anbazhagan R. (2014). Turbo charger in two wheeler engine. *Middle - East Journal of Scientific Research, 20*(12), 1841-1847.

[29] Vanangamudi S., Prabhakar S., Thamotharan C., & Anbazhagan R. (2014). Design and calculation with fabrication of an aero hydraulwicclutch. *Middle - East Journal of Scientific Research, 20*(12), 1796-1798, 2014.

[30] Saravanan, T., Raj, M.S., & Gopalakrishnan, K. (2014). VLSI based 1-D ICT processor for image coding. *Middle-East Journal of Scientific Research*, *20*(11), 1511-1516.

[31] Ajona, M., & Kaviya, B. (2014). An environmental friendly self-healing microbial concrete. *International Journal of Applied Engineering Research*, *9*(22), 5457-5462.

[32] Hemalatha, R., & Anbuselvi, S. (2013). Physicochemical constituents of pineapple pulp and waste. *Journal of Chemical and Pharmaceutical Research*, *5*(2), 240-242.

[33] Langeswaran, K., Revathy, R., Kumar, S.G., Vijayaprakash, S., & Balasubramanian, M.P. (2012). Kaempferol ameliorates aflatoxin B1 (AFB1) induced hepatocellular carcinoma through modifying metabolizing enzymes, membrane bound ATPases and mitochondrial TCA cycle enzymes. *Asian Pacific Journal of Tropical Biomedicine*, *2*(3), S1653-S1659.

[34] Masthan, K.M.K., Babu, N.A., Dash, K.C., & Elumalai, M. (2012). Advanced diagnostic aids in oral cancer. *Asian Pacific Journal of Cancer Prevention*, *13*(8), 3573-3576.

[35] Asiri S., Güner S., Demir A., Yildiz A., Manikandan A., & Baykal A. (2018). Synthesis and Magnetic Characterization of Cu Substituted Barium Hexaferrites. *Journal of Inorganic and Organometallic Polymers and Materials,* 28(3), 1065-1071.

[36] Vellayappan, M.V., Jaganathan, S.K., & Manikandan, A. (2016). Nanomaterials as a game changer in the management and treatment of diabetic foot ulcers. *RSC Advances*, *6*(115), 114859-114878.

[37] Vellayappan, M.V., Venugopal, J.R., Ramakrishna, S., Ray, S., Ismail, A.F., Mandal, M., Manikandan, A., Seal, S., & Jaganathan, S.K. (2016). Electrospinning applications from diagnosis to treatment of diabetes. *RSC Advances*, *6*(87), 83638-83655.

[38] Bavitra, K., Sinthuja, S., Manoharan, N., & Rajesh, S. (2015). The high efficiency renewable PV inverter topology. *Indian Journal of Science and Technology*, *8*(14), 1.

[39] Vanangamudi, S., Prabhakar, S., Thamotharan, C., & Anbazhagan, R. (2014). Design and fabrication of dual clutch. *Middle-East Journal of Scientific Research*, *20*(12), 1816-1818.

[40] Sandhiya, K., & Kaviya, B. Safe bus stop location in Trichy city by using gis. *International Journal of Applied Engineering Research*, *9*(22), 5686-5691.

[41] Selva Kumar, S., Ram Krishna Rao, M., Deepak Kumar, R., Panwar, S., & Prasad, C.S. (2013). Biocontrol by plant growth promoting rhizobacteria against black scurf and stem canker disease of potato caused by Rhizoctonia solani. *Archives of Phytopathology and Plant Protection*, *46*(4), 487-502.

[42] Sharmila, S., & Jeyanthi Rebecca, L. (2012). GC-MS Analysis of esters of fatty acid present in biodiesel produced from Cladophora vagabunda. *Journal of Chemical and Pharmaceutical Research*, *4*(11), 4883-4887.

[43] Ramkumar, M., Rajasankar, S., Gobi, V.V., Dhanalakshmi, C., Manivasagam, T., Thenmozhi, A.J., Essa, M.M., Kalandar, A., & Chidambaram, R. (2017). Neuro protective effect of Demethoxycurcumin, a natural derivative of Curcumin on rotenone induced neurotoxicity in SH-SY 5Y Neuroblastoma cells. *BMC complementary and alternative medicine*, *17*(1), 217.

[44] Selvi, S.A., & Sundararajan, M. (2016). A Combined Framework for Routing and Channel Allocation for Dynamic Spectrum Sharing using Cognitive Radio. *International Journal of Applied Engineering Research*, *11*(7), 4951-4953.

[45] Krupaa R.J., Sankari S.L., Masthan K.M.K., & Rajesh E. (2015). Oral lichen planus: An overview. *Journal of Pharmacy and Bioallied Sciences, 7,* S158-S161.

[46] Srividya, T., & Saritha, B. (2014). Strengthening on RC beam elements with GFRP under flexure. *International Journal of Applied Engineering Research*, *9*(22), 5443-5446.

[47] Kumar, J., Sathish Kumar, K., & Dayakar, P. (2014). Effect of microsilica on high strength concrete. *International Journal of Applied Engineering Research*, *9*(22), 5427-5432.

[48] Saraswathy, R., & Saritha, B. (2014). Planning of integrated satellite township at Thirumazhisai. *International Journal of Applied Engineering Research*, *9*(22), 5558-5560.

[49] Saritha, B., Ilayaraja, K., & Eqyaabal, Z. (2014). Geo textiles and geo synthetics for soil reinforcement. *International Journal of Applied Engineering Research*, *9*(22), 5533-5536.

[50] Iyappan, L., & Dayakar, P. (2014). Identification of landslide prone zone for coonoor taluk using spatial technology. *International Journal of Applied Engineering Research*, *9*(22), 5724-5732.