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RRNS Based Multiple Error Detection and Correction in CDMA System

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Abstract: *In communication systems corruption of data and hacking of data is unavoidable. These are the major problems we are facing in communication system. This project presents an enhanced multiple error detection and correction scheme based on the Redundant Residue Number System (RRNS). RRNS is often used in parallel processing environments because of its ability to increase the robustness of information passing between the processors. The proposed multiple error correction scheme utilizes the Chinese Remainder Theorem (CRT) together with a novel algorithm that significantly simplifies the error correcting process for integers. This enhanced scheme is compared with the existing method and this enhanced scheme is used in the CDMA application.*

Keywords--- *Redundant Residue Number System (RRNS)**,** Chinese Remainder Theorem (CRT) CDMA*

I. INTRODUCTION

In the field of digital communication, errors and fading are the major problems faced. To overcome this problem, many error detection and correction methods have been proposed.

The main objective of this project is to correct more errors with less redundancy based on RRNS and this enhanced scheme is used in the CDMA application. A Residue Number System (RNS) for integers describes methods of representing an integer as a set of its remainders or residues. Error control is achieved by addition of extra residues, hence the term RRNS.

The RRNS code used in this work uses the Chinese Remainder Theorem (CRT) as a means of recovering the integer from a set of its residues. Error correcting codes based on the CRT are attractive because of their ability to perform carry-free arithmetic and lack of ordered significance among the residues. Some of the concepts related to this error correction technique such as the terms legitimate range and illegitimate range for consistency checking.

There are three main chapters describing about the transmitter, channel and receiver. The input is given to the RNST to get a set of residues and these residues are mapped to the orthogonal codes generated. The sum of the orthogonal codes are added and a user specific scrambling code is multiplied to the codes. Then the signal is modulated using the QAM modulation scheme and the signal is transmitted. There are two paths and their corresponding impulse responses are assumed and additive white Gaussian noise is added to the signal. The faded signal is received by the receiver and the same signal is divided into several fingers equal to the number of residues. Each finger is further divided into number of paths equal to the number of paths assumed and the scrambling code

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and conjugate of the impulse are multiplied. Then this output is given to the correlator bank. This is done for all paths and added, the maximum of the value is taken and the index is taken as the residue. These recovered residues are given to the CRT to recover the integer. By doing other operations in the receiver according to the algorithm the output is recovered.

II. PROPOSED SYSTEM

RRNS (RESUDUE REDUNDENCY NUMBER SYSTEM):

A residue number system (RNS) represents a large integer using a set of smaller integers, so that computation is performed more efficiently. It relies on the Chinese remainder theorem of modular arithmetic for its operation, a mathematical idea from Sun Tsu Suan-Ching, when redundant residues are added to the information residues then it is called redundant residue number system. The receiver applies the same algorithm to the received data bits and compares its output to the received check bits; if the values do not match, an error has occurred at some point during the transmission. In a system that uses a "non-systematic" code, such as some raptor codes, data bits are transformed into at least as many code bits, and the transmitter sends only the code bits.

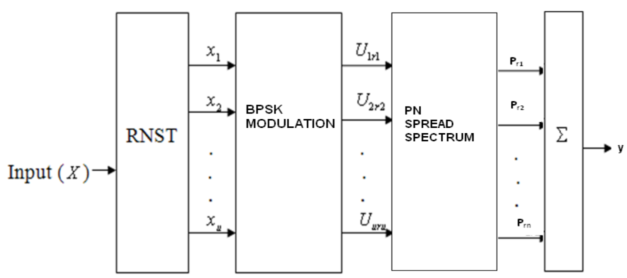

Figure 2.1Transmitter Model

CHINESE REMAINDER THEOREM

The Chinese remainder theorem is a result about congruence in number theory and its generalizations in abstract algebra. The Chinese remainder theorem can also be used in Secret sharing, which consists of distributing a set of shares among a group of people who, all together (but no one alone), can recover a certain secret from the given set of shares. Each of the shares is represented in a congruence, and the solution of the system of congruence using the Chinese remainder theorem is the secret to be recovered. Secret Sharing using the Chinese Remainder Theorem uses, along with the Chinese remainder theorem, special sequences of integers that guarantee the impossibility of

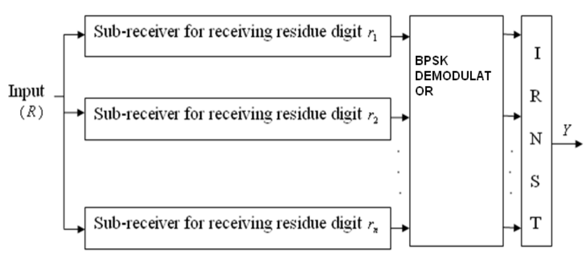

Figure 2.2 Receiver Model

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III. CHANNEL RESULT:

- During transmission, errors propagate into the residue vector *x* at positions u1= 1, u2=3, u3=5. Therefore, let the received vector be *y*= {2, 2, 2, 7, 3, 7}

x = {1, 2, 0, 7, 7, 7}

y = {2, 2, 2, 7, 3, 7}

Three errors are introduced because $t = r - 1 = 3$

IV. RECEIVER RESULT:

- From *y*, the computed integer Y using,

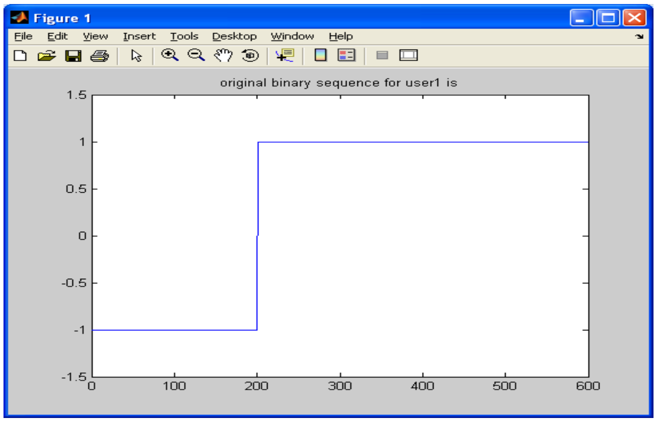
$$Y = \sum_{i=1}^{n} y_i M_i a_i \bmod M$$

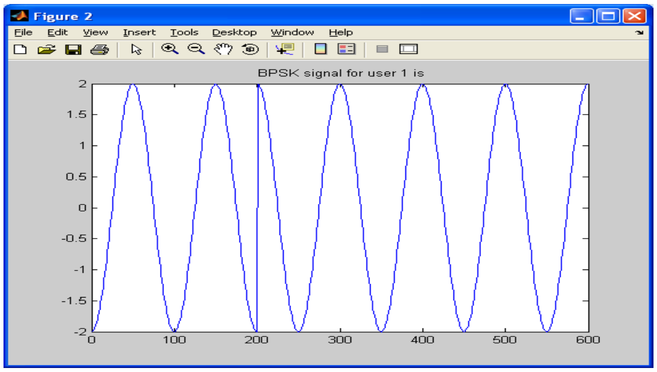
= 88832

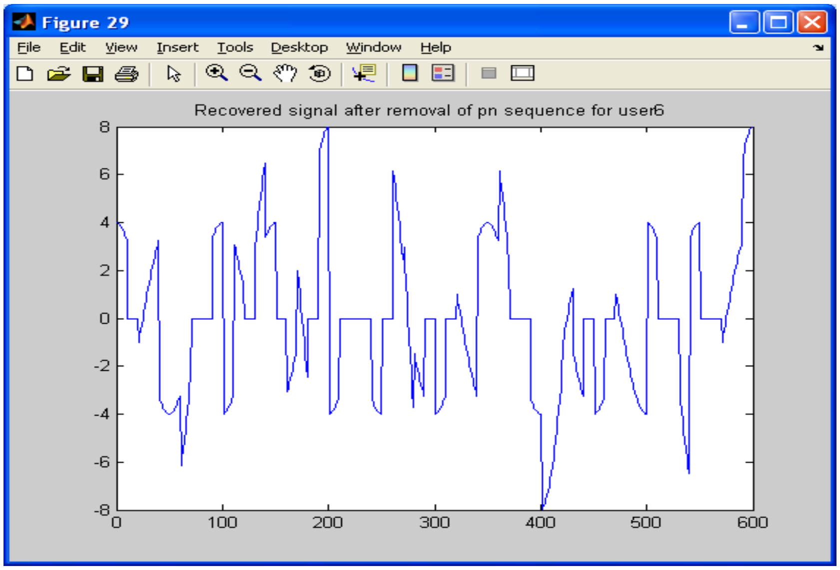
- The corresponding values of Mi and the multiplicative inverse are
- Mi = {85085,51051,36465,23205, 19635, 15015};
- ai = {2, 1, 4, 2, 8, 13};
- The minimum Hamming distance is 3. Hence the set = { 2, 7}.
- The moduli set for the integer 2 (elements in S) is {2, 3, 5, 7, 11, 13}.
- The moduli set for the integer 7 (elements in S) is {3, 5, 7, 11, 13, 17}.
- S = {11, 13, 17, 19, 23, 29, 31}

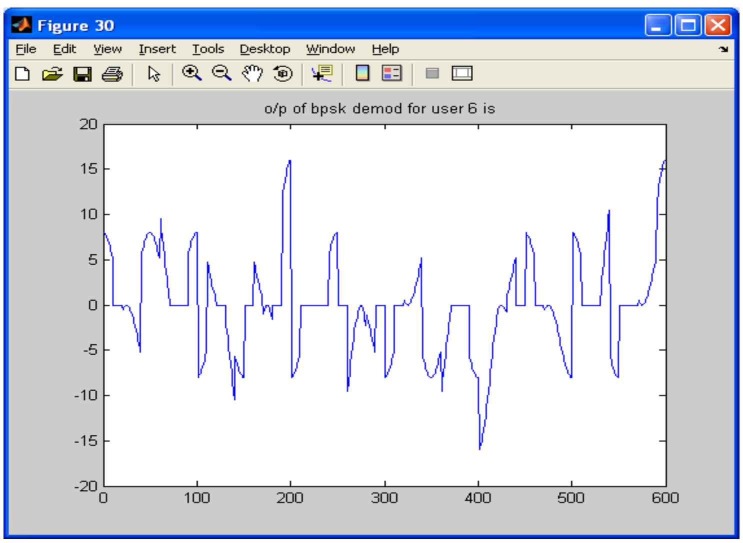
Since the moduli set for integer 7 and are same, the transmitted integer is 7.

V. RESULT ANALYSIS









VI. Conclusion

In this project, a modified algorithm is proposed for correcting multiple errors. This is different from existing multiple error correction schemes. This algorithm is quite simple and easy to implement. The proposed algorithm can correct more errors than the other existing schemes at the expense of marginal increase in computation and it is compared with the existing method without implementing in the CDMA application but when it is implemented in the CDMA application the BER is calculated for several SNR values.The future work is to reduce the number of orthogonal codes and computation.

References

[1] Udayakumar R., Khanaa V., Saravanan T., Saritha G., Retinal image analysis using curvelet transform and multistructure elements morphology by reconstruction, Middle - East Journal of Scientific Research, V-16, I-12, PP:1781-1785, 2013.

[2] Karthik B., Kiran Kumar T.V.U., EMI developed test methodologies for short duration noises, Indian Journal of Science and Technology, V-6, I-SUPPL5, PP:4615-4619, 2013.
[3] Bomila R., Srinivasan S., Gunasekaran S., Manikandan A., Enhanced photocatalytic degradation of methylene blue dye, opto-magnetic and antibacterial behaviour of pure and la-doped ZnO nanoparticles, Journal of Superconductivity and Novel Magnetism, V-31, I-3, PP:855-864, 2018.
[4] Manikandan A., Mani M.P., Jaganathan S.K., Rajasekar R., Jagannath M., Formation of functional nanofibrous electrospun polyurethane and murivenna oil with improved haemocompatibility for wound healing, Polymer Testing, V-61, PP:106-113, 2017.
[5] Saravanan T., Sundar Raj M., Gopalakrishnan K., Comparative performance evaluation of some fuzzy and classical edge operators, Middle - East Journal of Scientific Research, V-20, I-12, PP:2633-2633, 2014.
[6] Karthik B., Kiran Kumar T.V.U., Authentication verification and remote digital signing based on embedded arm (LPC2378) platform, Middle - East Journal of Scientific Research, V-20, I-12, PP:2341-2345, 2014.
[7] Gopalakrishnan K., Sundar Raj M., Saravanan T., Multilevel inverter topologies for high-power applications, Middle - East Journal of Scientific Research, V-20, I-12, PP:1950-1956, 2014.
[8] Sakthipriya N., An effective method for crop monitoring using wireless sensor network, Middle - East Journal of Scientific Research, V-20, I-9, PP:1127-1132, 2014.
[9] Vijayaragavan S.P., Karthik B., Kiran Kumar T.V.U., Effective routing technique based on decision logic for open faults in fpgas interconnects, Middle - East Journal of Scientific Research, V-20, I-7, PP:808-811, 2014.
[10] Kanniga E., Selvaramarathnam K., Sundararajan M., Kandigital bike operating system, Middle - East Journal of Scientific Research, V-20, I-6, PP:685-688, 2014.
[11] Sundararajan M., Optical instrument for correlative analysis of human ECG and breathing signal, International Journal of Biomedical Engineering and Technology, V-6, I-4, PP:350-362, 2011.
[12] Khanaa V., Thooyamani K.P., Saravanan T., Simulation of an all optical full adder using optical switch, Indian Journal of Science and Technology, V-6, I-SUPPL.6, PP:4733-4736, 2013.
[13] Slimani Y., Baykal A., Amir M., Tashkandi N., Güngüneş H., Guner S., El Sayed H.S., Aldakheel F., Saleh T.A., Manikandan A., Substitution effect of Cr 3+ on hyperfine interactions, magnetic and optical properties of Sr-hexaferrites, Ceramics International, V-44, I-13, PP:15995-16004, 2018.
[14] Suguna S., Shankar S., Jaganathan S.K., Manikandan A., Novel Synthesis of Spinel Mn x Co 1−x Al 2 O 4 (x = 0.0 to 1.0) Nanocatalysts: Effect of Mn 2+ Doping on Structural, Morphological, and Opto-Magnetic Properties, Journal of Superconductivity and Novel Magnetism, V-30, I-3, PP:691-699, 2017.
[15] Mathubala G., Manikandan A., Arul Antony S., Ramar P., Enhanced photocatalytic activity of spinel CuxMn1-xFe2O4 nanocatalysts for the degradation of methylene blue dye and opto-magnetic properties, Nanoscience and Nanotechnology Letters, V-8, I-5, PP:375-381, 2016.
[16] Kumaravel A., Dutta P., Application of Pca for context selection for collaborative filtering, Middle - East Journal of Scientific Research, V-20, I-1, PP:88-93, 2014.
[17] Krishnamoorthy P., Jayalakshmi T., Preparation, characterization and synthesis of silver nanoparticles by using phyllanthusniruri for the antimicrobial activity and cytotoxic effects, Journal of Chemical and Pharmaceutical Research, V-4, I-11, PP:4783-4794, 2012.
[18] Amir M., Gungunes H., Slimani Y., Tashkandi N., El Sayed H.S., Aldakheel F., Sertkol M., Sozeri H., Manikandan A., Ercan I., Baykal A., Mössbauer Studies and Magnetic Properties of Cubic CuFe 2 O 4 Nanoparticles, Journal of Superconductivity and Novel Magnetism, V-32, I-3, PP:557-564, 2019.
[19] Raj M.S., Saravanan T., Srinivasan V., A modified direct torque control of induction motor using space vector modulation technique, Middle - East Journal of Scientific Research, V-20, I-11, PP:1572-1574, 2014.
[20] Khanaa V., Thooyamani K.P., Using triangular shaped stepped impedance resonators design of compact microstrip quad-band, Middle - East Journal of Scientific Research, V-18, I-12, PP:1842-1844, 2013.
[21] Asiri S., Sertkol M., Güngüneş H., Amir M., Manikandan A., Ercan I., Baykal A., The Temperature Effect on Magnetic Properties of NiFe 2 O 4 Nanoparticles, Journal of Inorganic and Organometallic Polymers and Materials, V-28, I-4, PP:1587-1597, 2018.Thaya R., Malaikozhundan B., Vijayakumar S., Sivakamavalli J., Jeyasekar R., Shanthi S., Vaseeharan B., Ramasamy P., Sonawane A., Chitosan coated Ag/ZnO nanocomposite and their antibiofilm, antifungal and cytotoxic effects on murine macrophages, Microbial Pathogenesis, V-100, PP:124-132, 2016.
[22] Kolanthai E., Ganesan K., Epple M., Kalkura S.N., Synthesis of nanosized hydroxyapatite/agarose powders for bone filler and drug delivery application, Materials Today Communications, V-8, PP:31-40, 2016.

[23] Thilagavathi P., Manikandan A., Sujatha S., Jaganathan S.K., Antony S.A., Sol-gel synthesis and characterization studies of NiMoO 4 nanostructures for photocatalytic degradation of methylene blue dye, Nanoscience and Nanotechnology Letters, V-8, I-5, PP:438-443, 2016.
[24] Thamotharan C., Prabhakar S., Vanangamudi S., Anbazhagan R., Anti-lock braking system in two wheelers, Middle - East Journal of Scientific Research, V-20, I-12, PP:2274-2278, 2014.
[25] Thamotharan C., Prabhakar S., Vanangamudi S., Anbazhagan R., Coomarasamy C., Hydraulic rear drum brake system in two wheeler, Middle - East Journal of Scientific Research, V-20, I-12, PP:1826-1833, 2014.
[26] Vanangamudi S., Prabhakar S., Thamotharan C., Anbazhagan R., Collision control system in cars, Middle - East Journal of Scientific Research, V-20, I-12, PP:1799-1809, 2014.
[27] Vanangamudi S., Prabhakar S., Thamotharan C., Anbazhagan R., Drive shaft mechanism in motor cycle, Middle - East Journal of Scientific Research, V-20, I-12, PP:1810-1815, 2014.
[28] Anbazhagan R., Prabhakar S., Vanangamudi S., Thamotharan C., Electromagnetic engine, Middle - East Journal of Scientific Research, V-20, I-3, PP:385-387, 2014.
[29] Kalaiselvi V.S., Prabhu K., Ramesh M., Venkatesan V., The association of serum osteocalcin with the bone mineral density in post menopausal women, Journal of Clinical and Diagnostic Research, V-7, I-5, PP:814-816, 2013.
[30] Kalaiselvi V.S., Saikumar P., Prabhu K., Prashanth Krishna G., The anti Mullerian hormone-a novel marker for assessing the ovarian reserve in women with regular menstrual cycles, Journal of Clinical and Diagnostic Research, V-6, I-10, PP:1636-1639, 2012.
[31] Thanigai Arul K., Manikandan E., Ladchumananandasivam R., Maaza M., Novel polyvinyl alcohol polymer based nanostructure with ferrites co-doped with nickel and cobalt ions for magneto-sensor application, Polymer International, V-65, I-12, PP:1482-1485, 2016.
[32] Das M.P., Kumar S., An approach to low-density polyethylene biodegradation by Bacillus amyloliquefaciens, 3 Biotech, V-5, I-1, PP:81-86, 2015.
[33] Vanangamudi S., Prabhakar S., Thamotharan C., Anbazhagan R., Turbo charger in two wheeler engine, Middle - East Journal of Scientific Research, V-20, I-12, PP:1841-1847, 2014.
[34] Vanangamudi S., Prabhakar S., Thamotharan C., Anbazhagan R., Design and calculation with fabrication of an aero hydraulwicclutch, Middle - East Journal of Scientific Research, V-20, I-12, PP:1796-1798, 2014.
[35] Saravanan T., Raj M.S., Gopalakrishnan K., VLSI based 1-D ICT processor for image coding, Middle - East Journal of Scientific Research, V-20, I-11, PP:1511-1516, 2014.
[36] Ajona M., Kaviya B., An environmental friendly self-healing microbial concrete, International Journal of Applied Engineering Research, V-9, I-22, PP:5457-5462, 2014.
[37] Hemalatha R., Anbuselvi S., Physicohemical constituents of pineapple pulp and waste, Journal of Chemical and Pharmaceutical Research, V-5, I-2, PP:240-242, 2013.
[38] Langeswaran K., Revathy R., Kumar S.G., Vijayaprakash S., Balasubramanian M.P., Kaempferol ameliorates aflatoxin B1 (AFB 1) induced hepatocellular carcinoma through modifying metabolizing enzymes, membrane bound ATPases and mitochondrial TCA cycle enzymes, Asian Pacific Journal of Tropical Biomedicine, V-2, I-3 SUPPL., PP:S1653-S1659, 2012.
[39] Masthan K.M.K., Aravindha Babu N., Dash K.C., Elumalai M., Advanced diagnostic aids in oral cancer, Asian Pacific Journal of Cancer Prevention, V-13, I-8, PP:3573-3576, 2012.
[40] Asiri S., Güner S., Demir A., Yildiz A., Manikandan A., Baykal A., Synthesis and Magnetic Characterization of Cu Substituted Barium Hexaferrites, Journal of Inorganic and Organometallic Polymers and Materials, V-28, I-3, PP:1065-1071, 2018.
[41] Anand, K., Palanisamy, T., & Loganathan, R. (2014). Analysis of Torque Ripple and Speed Control of Five Phase BLDC Motor. *International Scientific Journal on Science Engineering & Technology, 17*(9), 886-892.
[42] Niranjana Murthy, H.S., & Dr.Meenakshi, M. (2015). ANN, SVM and KNN Classifiers for Prognosis of Cardiac Ischemia- A Comparison. *Bonfring International Journal of Research in Communication Engineering, 5*(2), 7-11.
[43] Sakuma, H. (2013). Improvement of One-shot FringeProjection for Shape Measurement. *The SIJ Transactions on Computer Science Engineering & its Applications, 1*(5), 7-11.
[44] Vidhya, K., & Saravanan, N. (2018). Enhanced Automatically Mining Facets for Queries and Clustering with Side Information Model. *Bonfring International Journal of Software Engineering and Soft Computing,* 8(2), 1-6.

[45] Aodsup, K., & Kulworawanichpong, T. (2014).FDTD Method for Lightning Surge Propagation of Power Transmission Lines. *The SIJ Transactions on Computer Networks & Communication Engineering (CNCE), 2*(4), 7-11.

[46] Sulyukova. (2019). Analysis of Low power and reliable XOR-XNOR circuit for high Speed Applications. *Journal of VLSI Circuits And Systems, 1*(1), 23-26.

[47] Deshpande, G.B., & Dr. Ramesha, K. (2015). MRI Brain Image Enhancement Using XILINX System Generator and DWT. *Bonfring International Journal of Advances in Image Processing, 5*(2), 16-22.

[48] Salimoddin, & Mohammed, A.M. (2018). Design of Error Detection Reed Solomon Codes at the Receiver.*Journal of Computational Information Systems, 14*(4), 1 - 6.

[49] Raj Raghul, S. (2014). A General View about Grid Computing and Its Concepts. *International Journal of Advances in Engineering and Emerging Technology, 5*(5), 225-233.

[50] Saranya, K., & Rajesh Kumar, B. (2015). Design and Implementation of GCPV System Based on GGC in Symmentrical LMV Network for Grid Stabilization. *Excel International Journal of Technology, Engineering and Management, 2*(1), 19-21.