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A Fuzzy Based Paperless Office (FBPO) Model facilitating Paperless Office

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Abstract: *The design of paperless office architecture has been provided in this research paper, exploring the underlining benefit of fuzzy logic in attaining linguistic variables and variables thereby providing robustness and handling uncertainties. This architecture has the propensity for cutting down operational cost and hardcopy documentation while handling organizational procedures and processes.*
Keywords: *Paperless office, Fuzzy Logic*

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I. Introduction

Numerous companies are turning toward cost-effective ways to conserve cost while preventing environmental degradation. These have resulted in huge automation of organization processes eliminating documentation and outright usage of papers (Fiserv,2012).Conventional offices;are paper-based filling systems; organize to support hard-copy documentation and equipment within an office space (Madden, 2009). These support and documentation perhaps may include document collection, evaluation and maintenance provided through file cabinet, folders, shelves and microfiche (Madden, 2009; Walker, 2009). A large volume of papers and documents, usually are the fallout of running a self-performing service-oriented company resulting in higher revenue usually constrained by associated costing for maintaining, filling, routing, reviewing, storing, retrieving of documents and papers an office (Workflow, 2009).

A paperless office can be perceived as a working environment in which the use of papers, documents and associated hardcopies are considerably eliminated or reduced. It is an environment where digital and software format dominate the overall functionalities of the organization (Sellen and Harper, 2003). Paperless adoption can invariably save money, boost productivity, foster reliability, privacy, save space and making information sharing very easy (Sellen and Harper, 2011). The technological infrastructure of a paperless office, may include all facilitates for the transformation of hardcopy documentation into electronic soft copies. These infrastructures must include stationery or mobile computers associated with peripherals which are network enabled, facilitating documents sharing and retrieval, remote access and onsite functionalities. A paperless office could be centralized, distributed and decentralized in which top management may decide the techniques for dissemination of electronic documents either from a central point, multi-points or a single point with associated support (Gladwell, 2002).

Paperless office has been perceived as the alternative to documentation and paper due to the associated issues tag with paper production. Paper products have contributed significantly to deforestation and climate change producing greenhouse gases. Fossil fuel has also increased greatly with the production of paper product (Madden, 2009). Although recycling and tree-free paper has contributed to in reducing environmental impact of paper, most paper still ends up in landfills (Gladwell, 2002). Environmental pollution can also be traced to paper production which has increased the release of nitrogen (NO_2) and sulfur dioxide (SO_2) and carbon dioxide (CO_2). Printing inks and toners are very expensive which has resulted in environment-damaging volatile organic compounds, heavy metals and non-renewable oils,

Actualizationof 100% paperless office (environment) in an organization perhaps is difficult due to human need, cost and infrastructure facilities. However, small change in efforts toward paperless system willachieve a higher inherent drive towards paperless office and a healthier environment. The overall benefit of paperless office cannot be overemphasized.

Paper documentation and processing has indeed been a tremendous bureaucratic bottleneck in Nigeria. It is the current trend from contract quotation to knowledge acquisition in Nigeria tertiary institution as well as regulatory weaknesses in governance (Garuba, 2009). Numerous organizations in Nigeria have not fully clutched the concepts paperless ofice, as a result they have not benefited from the numerous advantages of paperless office. It is on this hunt this research was based, therefore a paperless architecture.

II. Material and Method

The theory of fuzzy logic provides a mathematical strength to capture the uncertainties associated with human cognitive processes, such as thinking and reasoning. In standard set theory, an object does or does not belong to a set. There is no middle ground. In such bivalent systems, an object cannot belong to both its set and its compliment set or to neither of them. This principle preserves the structure of the logic and avoids the contradiction of object that both is and is not a thing at the same time (Zadeh, 1965). However, fuzzy logic is highly abstract and employs heuristic (experiment) requiring human experts to discover rules about data relationship (Angel and Rocio, 2011). Fuzzy classification assumes the boundary between two neighboring classes as a continuous, overlapping area within which an object has partial membership in each class (Kuang; Ting-Hua and Ting-Cheng, 2011**)**. Fuzzy logic highlights the significant of most applications in which categories have fuzzy boundaries, but also provides a simple representation of the potentially complex partition of the feature space. (Sun and Jang, 1993 and Ahmad, 2011) Conventional approaches of pattern classification involve clustering training samples and associating clusters to given categories. The complexity and limitations of previous mechanisms are largely due to the lackof an effective way of defining the boundaries among clusters. This problem becomes more intractable when the number of features used for classification increases (Christos and Dimitros, 2008). Fuzzy rule is a fundamental application of fuzzy logic which enables the classification of object based on underlined rules built on certain criteria's. On this hunt this research paper is built.

III. Fuzzy Based Paperless Office (FBPO)

The proposed model is an architectural framework employing fuzzy rules built on paperless office criteria. This approach will have the capability of handling uncertainties as regards hardcopy documentation and classification within a workspace which is an advantage over traditional or conventional approach. The model is an Artificial Intelligence (AI) fuzzy based model which ensures that failures and success are no dependent on human intuition but on assiduous implementation of model components. Figure 3.1 captures the FBPO model.

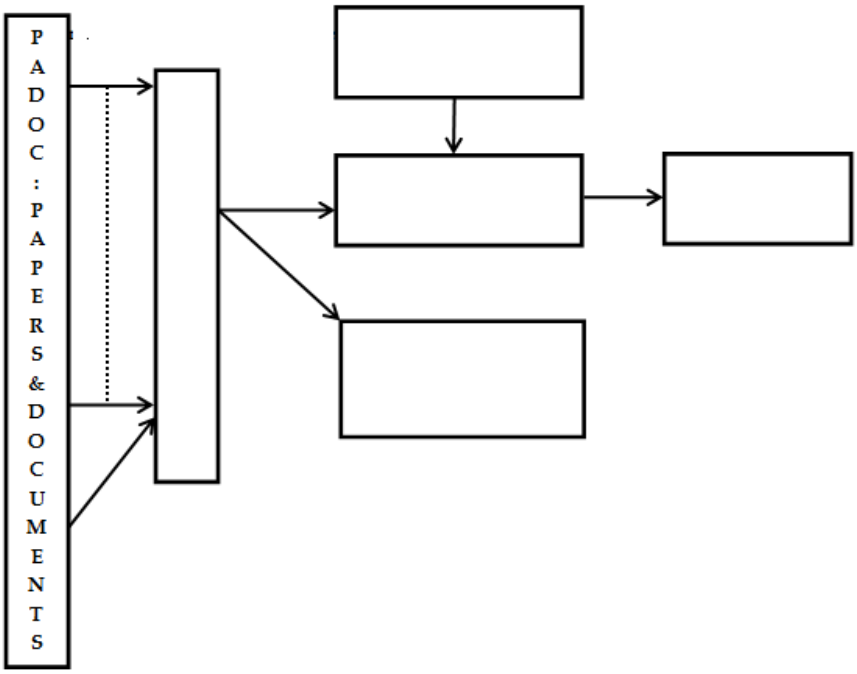

Figure 3.1: Fuzzy-Based Paperless Office (FBPO) Model

Fuzzy Based paperless Office (FBPO) comprises of several components which includes PADOC, SEP, FRA, THS, MH and APS. This components work in unison in achieving paperless office.

a. **PADOC:**The PADOC denote paper and documentation which hold organizational hardcopies (documentation and papers) in any format prior to the separator processes. The contents of the PADOC are retrieval both from the organization internal or external environments inclusive of documents generated from various departments within the organization. This department includes the human resource, personnel, financial, public relation and information and communication. External content such as market prices, customer complaints, government change policy and taxation issues are all contained within PADOC.
b. **SEP:** The SEP denotes separator; select relevant documents, determining maintenance of hardcopy and transformation of softcopy based on organizational criteria. These criteria usually differ from organizations

based on its operation processes and established organization procedures and policies. The SEP precedes fuzzy application and succeeds PADOC. It is an intermediary connecting PADOC content with fuzzy application or maintaining such hard copy.

c. **THS:** The THS denotes transform hardcopy to softcopy, transform hard copy to soft copy using various automated and electronic format established and accepted by the organization top management. The operation of the THS is largely dependent on the selected hardcopy coming from the separator. These hardcopy are confirmed using fuzzy rules prior to archive with privacy security ensuring that only hardcopy satisfied these rules are archived.

d. **MHA:** The MH maintain documents and paper as hardcopy

e. **FRA:** The FRA denotes Fuzzy rule application, this rule determines archived with security privacy. The rules are formed using the fuzzy accepted criteria's which include: Relevant, Privacy, Voluminous, Huge-Cost, Large-Distribution, Huge-Time and External policies established within the organization.

i. **Relevant:** The transform of hardcopy into electronic must be done determining relevant of such hardcopy to the organization. Hardcopy lacking relevant are thrust side, causing indeed it is not cost effectives.

ii. **Privacy:** Privacy is indeed a determinant for the transform of hardcopy document into electronic or softcopy knowing that documents are better security with electronic format compared to securing these hardcopy with physical protection mechanism.

iii. **Voluminous**: Voluminous hardcopy simply incurred large dost for storage, filing, reviewing, routing and maintaining these documents. Therefore, if these documents are largely to incurred huge organizational cost they are better stored in electronic format to prevent unnecessary organization cost.

iv. **Huge-Cost:** The cost incurred in handling hardcopy is usuallyhigher compared to electronic softcopy document. Therefore, if the cost is huge is advisable we deplore paperless approach.

v. **Large Distribution:** The easy of distribution of softcopy cannot be compared with the distribution of electronic document.

vi. **Huge-Time;** The time constraint in maintaining, transforming and reviewing hardcopy are usually large making electronic copies more suitable.

vii. **External Policies:** External Policies can force the movement toward electronic format, especiallyif not favorable in term of time.

The fuzzy partition for each input feature consists of the parameters for assessing the relevant of paperless office based on stated criteria. The fuzzy rules that can be generated from the initial fuzzy partitions for the classification of paperless office are thus:

a.Non-Implement Paperless office (Class: C_1)

b. Might Implement Paperless office (Class: C_2)

c. Implement Paperless Office (Class: C_3)

If the Organization (M) experiences less than or equal to two ($M \leq 2$) of the parameters for assessing Paperless office*THEN* (C_1), If the Organization (M) experiences three ($M = 3$) of the parameters for assessing Paperless Office *THEN* (C_2), If the Organization (M) experiences four ($M \geq 4$) or more parameters for assessing paperless Office THEN(C_3).

Rules 1: If the organization hardcopies are (Relevant) THEN C_1.

Rule 2: If the organization hardcopies are (Relevant)& the organization requires (Privacy) THEN C_1.

Rule3: If the organization hardcopies are (Relevant)& the organization requires (Privacy) & the organization document are (Voluminous) THEN C_2.

Rule 4: If the organization hardcopies are (Relevant)& the organization hardcopies requires (Privacy)& the organization hardcopies are (Voluminous)& the organization hardcopies incurs (Huge-Cost) THEN C_3.

Rule 5: If the organization hardcopies are (Relevant)& the organization hardcopies requires (Privacy) & the organization hardcopies are (Voluminous)& the organization hardcopies incurs (Huge-Cost) & organization explore (Large-Distribution) THEN C_3.

Rule 6: If the organization hardcopies are (Relevant)& the organization hardcopies requires (Privacy)&the organization hardcopies are (Voluminous)& the organization hardcopies incurs (Huge-Cost) & organization explore (Large-Distribution) & organization process explore (Huge-Time) THEN C_3.

Rule 7: If the organization hardcopies are (Relevant)& the organization hardcopies requires (Privacy) & the organization hardcopies are (Voluminous)& the organization hardcopies incurs (Huge cost) & organization explore (Large-Distribution) & organization process explore (Huge-Time) &(External-Polices) THEN C_3.

f. **APS:** The APS denotes Archive Privacy Security, which provide authentication through security control put in place.

IV. Discussion

Paperless office architecture has been designed with the integral components of fuzzy logic which provide robustness compared with the traditional approaches. The architecture cut down the tremendous usage of paper and documentation hardcopy considerably within an organization. It also applies linguistic value tied to linguistic variable for proper classification. This approach on fully implementation will save organization time and organization overhead cost.

V. Conclusion

Paperless office architecture has been developed with the full aim of cutting down tremendously on hardcopy usage within an organization. This architecture is explored the full benefit of fuzzy logic, accounting for linguistic variables and values.

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