

Model of a Mobile Agent for Correctional Facility

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ABSTRACT: Overcrowding is the bedrock of the challenges of Correctional facilities mostly in the developing countries. If left unchecked, this rottenness in the correctional facilities will permeate the annals of the nation's economy. The aim of this study is to design a model for the correctional facilities that will aid the presiding Judge or Magistrate in sentencing a criminal based on the available accommodation spaces in the correctional facilities thereby controlling the problem of overcrowding. To actualise the aim of the study, a model is designed using C# at the front end and Microsoft access at the backend.

KEYWORDS: Prison, Correctional Facility, Mobile Agent, Model

I. INTRODUCTION

A prison, also known as a correctional facility, jail goal (dated, British English), penitentiary (American English), detention center (American English) or remand center is a facility in which inmates are forcibly confined and denied a variety of freedoms under the authority of the state. Prisons are most commonly used within a criminal justice system: people charged with crimes may be imprisoned until they are brought to trial; those pleading or being found guilty of crimes at trial may be sentenced to a specified period of imprisonment. Besides their use for punishing crimes, jails and prisons are frequently used by authoritarian regimes against perceived opponents. [1]

Prison management in Nigeria has long been of Negligence to the Government and to the society at large. It has been observed that the state of prison services in Nigeria continues to degrade at a very fast pace. Fueled by high crime rate in Nigeria, the Nigerian Prison service has of late exceeded its intended number of inmates from

50,153 [2] to a controversial number of 72,277 inmates [3]. Currently, a rudimentary process of storing prisoners' data in manual files and registers is in place, necessitating a lot of records keeping for the inmates both in the remand and prison department. These records include files of approximately 72,277 inmates [3] and their case details, such as: the prison name, details of where they come from, records about the block and room they are allocated, health records and records of the people who come to visit them. As a result, when a prisoner's report is needed, it takes longer time to produce to enable management make decisions. Oftentimes, reports disappear and tracing them becomes a problem since the system is not automated. Considering the administrative problems posed by most existing manually oriented system of information management and the security oriented nature of the Nigerian prison services, manual procedures for the job execution brings about delay and reduces one's output. Also the sensitive information to be generated from the available data cannot be optimally utilized due to the sluggish and ineffective nature of the manual system. There is a need for centralization of prisoners' data to facilitate information exchange and data sharing to the users of the prison as well as the need for timely information to support management in making decisions, which calls for developing a database system for Nigerian prison as an answer to the above problems of managing prison records at Nigerian prison service branches in order to cope up with the increasing number of prisoners being lodged in, reduce administrative overheads, speed up responsiveness to users, reduce risks involved in inmate's custody, eliminate obsolete processes and reap cost-cutting benefits.

A mobile agent has the following properties: state, implementation, interactions and a unique identifier [4]. The state abstracts the agent functionality and represents the agent in the system. Agent implementation defines its behavior and interactions enable the agent to reason about its environment and to co-operate. A unique identifier is needed to address the agent globally. The agent can also have metadata related to its operation and interactions, such as security and privacy attributes.

The concept of “agent” has become important in artificial intelligence, computer science, and E-commerce [5]. Agents are used to denote a software-based computer system that possesses the following properties: autonomy (agents operate without the direct intervention of humans); social ability (agents communicate with other agents); reactivity (agents perceive their environment and respond in a timely fashion to changes that occur in it); proactively (agents do not simply act in response to their environment, they are able to exhibit goal directed behavior by taking the initiative); mobility (agents are able to travel through computer networks). In general, an agent on one computer may create another agent on another computer for execution.

Agents may also transport from computer to computer during execution and may carry accumulated knowledge and data with them. There has been a recent accretion of approaches for building multi agent systems for Internet applications [6]. The intelligent agents provide an effective means for systematic monitoring of financial transactions in the corporate world, to detect and report any abnormal financial transactions that may signify a high risk, fraud, and other financial inconsistencies.

The aim of this study is to develop a Mobile Agent system for the Nigeria correctional services that will assist in reducing problems of over-population which is the bedrock of other problems facing the Nigeria Correctional centers.

II. LITERATURE REVIEW

A. Prison Systems

Prison is defined as a custom and tradition of society according to the law of the land to punish anyone or person who commits a crime. This is to prevent (a lawless society which invariably help secure) lives and properties of the people living in such a country or state. It is also a place in which individuals are physically confined or interned and usually deprived of personal freedom. This is usually a legal penalty that may be imposed by the state for committing a crime. It is also defined as the criminal law forbids the

commission or omission of certain acts in order to preserve public order protect person or property from what is offensive and injurious and provide sufficient safeguards against corruption of the state [7]. The prison, as an institution and an environment, is manipulated by both inmate and guard to help ease the passing of time and work and to sustain some individual identity within the institution, which can undermine the intended purpose of the prison.

In short to understand the prison and its purpose, “we must see prison life as something more than a matter of walls and bars, of cells, and locks...we must see the prisons as a society within a society” Once an inmate is surrounded by the prison walls, he or she becomes subject to the operation and function of the institution [8]. The prison environment contains a large number of stimuli (i.e. factors) that impacts both the behavior of inmates and their attitudes of the prison environment. This section presents and reviews information about the following areas: prison environment; types of prison security (i.e. minimum, medium, close, and maximum); consequences of the prison environment incorporating personal inmate accounts; and methods of reducing inmate stressors of the environment [9].

Study and analysis of prison environment, along with its subsequent features, composes the body of much research and analysis [10], [11], [12] and assists in allowing for a better understanding of the prison milieu. By studying the prison environment and the habits, behavior systems, customs, traditions, inmate codes, laws, and rules which are the features of the prison environment, it will allow for insight into an unseen world that can be viewed from eight specific dimensions [13]. Those dimensions are as follows: structure, privacy, support, activities, emotional support, freedom, social relations, and safety. [12] presents a clear and succinct assessment on the meaning of these dimensions:

[14] in studying leisure activities recognize that inmate participation in activities, specifically recreational, has been reinforced within the prison environment as a useful means of reducing and calming “the monotony of prison life and as a safety valve to release built-up emotions and tensions”. However, even though inmate encouragement has been a relatively recent occurrence when applied to the history of the American prison, the idea of recreational activities serving as a rehabilitative measure is not. During the era of the separate system, inmate cells constructed in Pennsylvania contained small yards

for recreation and a Bible. The time allowed in the cell yards for recreation was thought to help in reforming the inmate as was the Bible. The use of the Bible as tool of reform can still be seen in today's prisons and carries some substance. In a study of religious prison programs, [15] found that inmates "most active in Bible studies [sic] were significantly less likely to be arrested during a 1-year follow-up period". Additionally, those involved in such programs were less likely to recidivate as shown in a 1-year follow up study.

Emotional feedback concerns several areas. It concerns the relationships guards form with inmates and the rapport they establish along with relations among other inmates. To a greater degree, this dimension also concerns the frequency of visits or letters inmates receive and the measurement of inmate feelings. For inmates who receive visitors, both males and females, the interaction between the two parties is an important experience and can provide the inmate with a short release from the daily doldrums of prison life. In a study that examined adjustment among older inmates,

[16] found that females who were serving lengthy sentences are less likely to receive visitors than males as they aged. This finding shares some correlation to a study of a British female prison that found "contacts with the local community to be minimal" [17]. This finding was based on the location of the female prison and the security setting. Thus, if the prison is in a rural setting, inmates are less likely to receive visitors due to such features as geographical constraints posed on visitors. Conversely, if the prison is located in or near to an urban setting, inmates may be more likely for visitations due to proximity and transportation options. [16] found that depression and anxiety were associated with their findings on visitation; additionally, sentence length, according to [18] was correlated with acts of self-harm such as suicide with higher rates found for those on remand.

Crowding is a prominent feature of many prisons and carries several important issues worthy of mention. In a study on crowding in female prisons, [19] found that crowding was correlated to several negative effects dependent on the "population average and the log of the infraction rate" of the prison facility. [11] found that interpreting events as aggressive were correlated to experiences of crowding with those inmates involved in aggressive acts seen as "hostile, intentional, and malevolent". Upon further examination of prison crowding, [11] supported by [10] found that crowding was correlated with

increased levels of "arousal, stress, and fatigue". [9] cited violation of 'personal space' as a major contributor to violence and posited it on crowding, underlie by the combination of high density and close proximity.

B. Concepts Of Mobile Agents.

Agent's term comes from two distinct domains: the distributed systems domain and the multiagent systems domain. These last belongs in the base to intelligence artificial domain, where the programmers tent to imitate humane intelligence [20].

The performance of mobile agent in courseware acquisition was presented in [21]. The focus of the model was to reduce the user man hour period on the system. In the model the mobile agents visit all the available places during the migration. During migration, information needed are retrieved from the database and displayed to the user as they are gotten. With the recent exposure to the diverse and mobile society, new technologies and expanding opportunities, the developed system shall help to ensure that the students are prepared to become the future generation of parents, leaders, workers, and citizens.

C. Classification of Software Agents

Classification refers to the study of types and entities. There are several dimensions to classify existing software agents. They can be classified according to: the tasks they perform; their control architecture; the range and effectiveness of their actions; the range of sensitivity of their senses; or how much internal state they posses [22]. In this paper we classify agents, along several ideal and primary characteristics that agents should exhibit.

We identify three characteristics: autonomy, learning, and cooperation. [23]. Let us start by elaborating a bit more on these characteristics. Autonomy refers to the characteristic that an agent can operate on its own without the need for human guidance. In other words, an agent has a set of internal states and goals, it acts in such a manner to meet its goals on behalf of the user. Cooperation with other agents is necessary to accomplish a complicated task. In order to cooperate however, an agent must posses a social ability that allows it to interact with other agents. Finally, an agent is intelligent if it is able to learn and sense as it acts and reacts to its external environment.

III. THE MATHEMATICAL MODEL

The mathematical model presented in [24] and modified in [25] using push migration

was the strategy adopted for the design of the mobile agent. The Focus of this research is to develop a mobile agent for correctional service centers so to reduce problems of overcrowding. The safety of data and hardware relies on its performance. When a computer is started, the operating system will run a number of processes. It is to ascertain the security level of the machine as far as malicious items are concerned. In LAN environment, the issue becomes more problematic. But, these applications may face some problems in the performance. The problems may relate to the agent size. The mobile agent size may increase during a journey. Some hosts may reject to receive the mobile agent in case it has a large size. Also, a mobility of The agent consumes more time and increases the network traffic. This model is an approach that reduces the mobile agent size during its journey. As a result of reducing the agent size, the performance will be improved, and the agent will be more accepted by the hosts. The main idea behind of this approach is to remove some unwanted parts from the agent load (L). This will

allow the agent to gather information about the available accommodation spaces in correctional facilities.

If the MA starts from home, the home node is represented by B_h and the migration can be represented as: $I = \{B_h, n_1, n_2, n_3, \dots, n_m\} \dots (1)$

where B_h is the home node and n_i ($i \geq 1$) is the i^{th} node to be visited in the network. We define I_j as the migration of MA and when the numbers of nodes to be visited are large (m), the number of MA needed to visit the network is denoted by N. Assume that the length of the state information (bytes) is B_s and this is constant throughout the agent life span. Then, initial load B_h of MA from home to the first target node is calculated as:

$$B_h = B_c + d_h + B_s \dots \dots \dots (2)$$

A schematic configuration of the basic structure of a node that has database of security application, a controller and an output MA of reduced size is illustrated in fig.1.

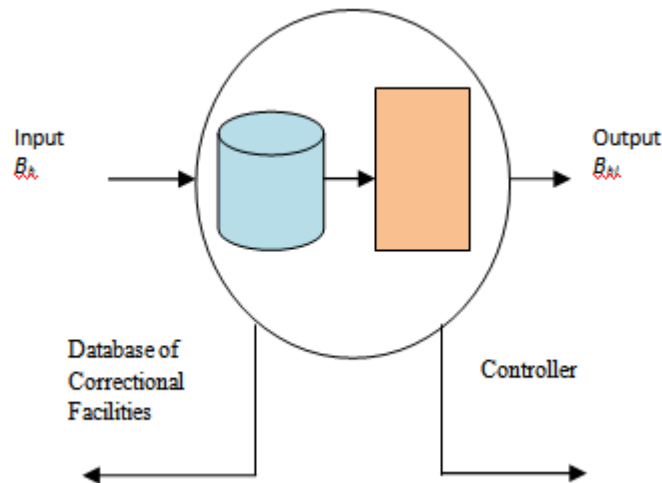


Figure 1; Schematic configuration of the basic structure of a node with Controller

The load after collecting information on the available accommodation spaces at the correctional facilities on the first target and the removal of its unwanted contents by the controller attached to the node through regression, whereby reducing its load is B_{h1} .

And the new load B_{h1} of MA from home to the first target node is;

$$B_{h1} = B_c + d_{h1} + B_s \dots \dots \dots (3)$$

The load of Migration to the next node is;

$$B_{h2} = B_c + d_{h2} + B_s \dots \dots \dots (4)$$

With this model, the load at each node is further reduced because of the effect of the controller, hence a migration from n_k to n_{k+1} with $k = 1, 2, \dots, m-1$ has a network load of:

$$B_{m1} = B_c + d_{m1} + B_s + \sum_{k=1}^{m-1} d_k \dots \dots \dots$$

(5)

The load when the Agent returns home (Mobile Agent base) is given by:

$$B_r = d_h + B_s + \sum_{k=1}^m d_k \dots\dots\dots$$

(6)

The sizes of the MA load in the visited nodes are represented by $B_{h1} \leq B_{h2} \leq B_{h3} \dots \leq B_{hm} \dots\dots\dots$ (7)

Let the load of the output of the first node be denoted

as B_{h1} , which is smaller than the load of the Second output B_{h2} ; B_{h2} is smaller than the load of the third output B_{h3} and $B_{h3} \leq$ the load of the last Node B_{hm} .

IV. ARCHITECTURE OF MOBILE AGENT FOR CORRECTIONAL FACILITY

The architecture of a mobile system adopted in this research consists of two types of agents namely: the static agents, otherwise referred to as Server agents, and the mobile agent referred to as Agent Monitor, together with their underlying software and hardware infrastructure. On the other hand, the architecture of the mobile agent system

can also be categorized as comprising of backend and frontend engines. The backend engine comprises of the server machine and nodes that are considered to be static. The frontend is the software-based interface, which creates the environment for creating and launching the mobile agent and is dynamic in nature. The architecture of the mobile agent is as conceptualized in Figure 2. The platform for the take-off of the Agent Monitor at the server host and the platform for its landing at the target workstations are their respective operating systems. At the server host, the Agent Monitor is created and equipped with the code, data, and other necessary parameters and dispatched to the target workstations in the network. The Agent Monitor then navigate autonomously through the network from the server end and interact with the host operating system of the target workstations, and it's utility programs as it processes the desired information.

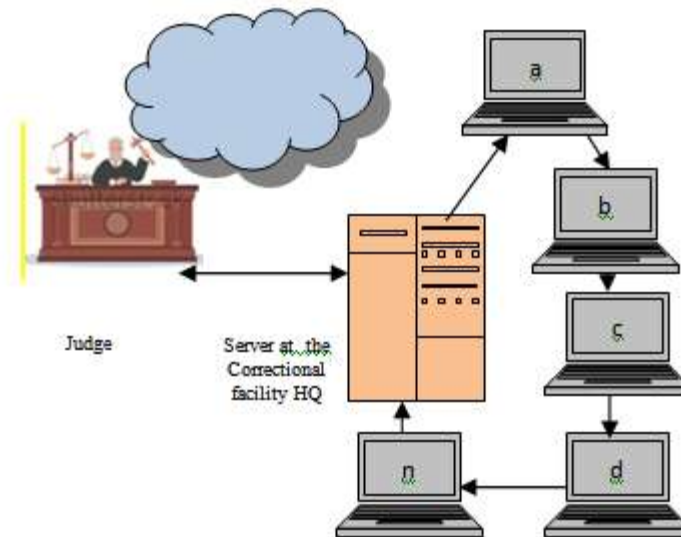


Fig.; 2 Design of a Mobile Agent for Correctional facility

The Agent Monitor moves from one workstation to another while carrying along intermediate results. The results obtained by the mobile agent after successful visits to a set of target workstations are transferred to the server, which

will enable the Judge to know which of the facilities have enough accommodation (space) for the criminal to be sentenced. The Migration flow of the agent is in Figure 3.

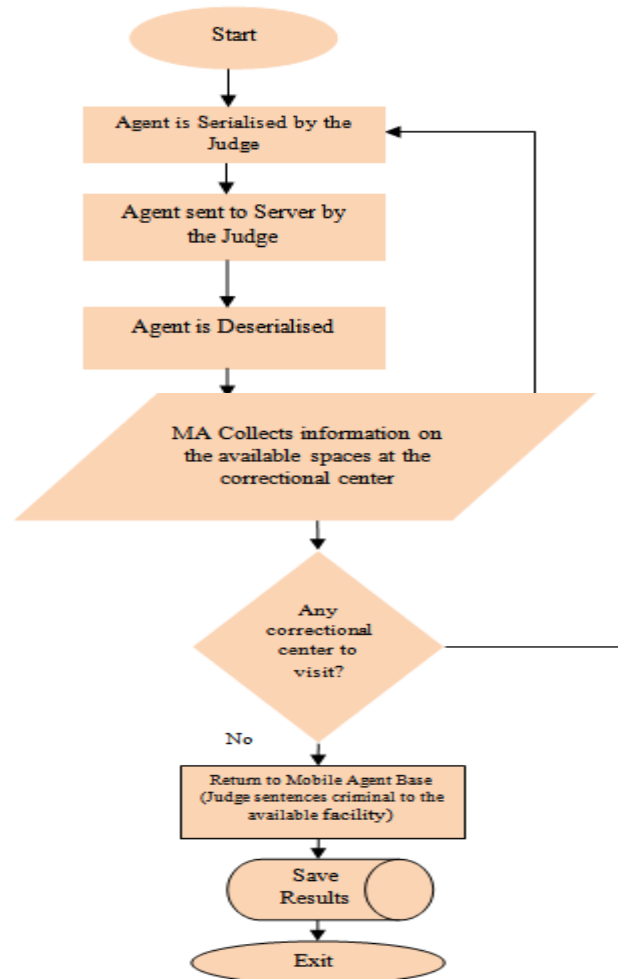


Fig.; 3 Migration flow of the Mobile Agent.

V. CONCLUSION

A mobile Agent model for correctional facilities has been presented in this paper. With overcrowding been the bedrock of problems facing correctional facilities in developing nations and the necessary application of the model by the respective Judges or Magistrates, in a matter of short time the problem of overcrowding and its related problems will be an issue of the past. However necessary infrastructure by the judiciary and the correctional facilities must be put in place. Future work; The implementation of this model is advised.

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