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EDITORIAL PREFACE

This is first issue of volume seven of the International Journal of Computer Science and Security (IJCSS). IJCSS is an International refereed journal for publication of current research in computer science and computer security technologies. IJCSS publishes research papers dealing primarily with the technological aspects of computer science in general and computer security in particular. Publications of IJCSS are beneficial for researchers, academics, scholars, advanced students, practitioners, and those seeking an update on current experience, state of the art research theories and future prospects in relation to computer science in general but specific to computer security studies. Some important topics cover by IJCSS are databases, electronic commerce, multimedia, bioinformatics, signal processing, image processing, access control, computer security, cryptography, communications and data security, etc.

The initial efforts helped to shape the editorial policy and to sharpen the focus of the journal. Started with volume 7, 2013, IJCSS is appearing with more focused issues. Besides normal publications, IJCSS intend to organized special issues on more focused topics. Each special issue will have a designated editor (editors) – either member of the editorial board or another recognized specialist in the respective field.

This journal publishes new dissertations and state of the art research to target its readership that not only includes researchers, industrialists and scientist but also advanced students and practitioners. The aim of IJCSS is to publish research which is not only technically proficient, but contains innovation or information for our international readers. In order to position IJCSS as one of the top International journal in computer science and security, a group of highly valuable and senior International scholars are serving its Editorial Board who ensures that each issue must publish qualitative research articles from International research communities relevant to Computer science and security fields.

IJCSS editors understand that how much it is important for authors and researchers to have their work published with a minimum delay after submission of their papers. They also strongly believe that the direct communication between the editors and authors are important for the welfare, quality and wellbeing of the Journal and its readers. Therefore, all activities from paper submission to paper publication are controlled through electronic systems that include electronic submission, editorial panel and review system that ensures rapid decision with least delays in the publication processes.

To build its international reputation, we are disseminating the publication information through Google Books, Google Scholar, Directory of Open Access Journals (DOAJ), Open J Gate, ScientificCommons, Docstoc and many more. Our International Editors are working on establishing ISI listing and a good impact factor for IJCSS. We would like to remind you that the success of our journal depends directly on the number of quality articles submitted for review. Accordingly, we would like to request your participation by submitting quality manuscripts for review and encouraging your colleagues to submit quality manuscripts for review. One of the great benefits we can provide to our prospective authors is the mentoring nature of our review process. IJCSS provides authors with high quality, helpful reviews that are shaped to assist authors in improving their manuscripts.

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Cost Benefits of Cloud vs. In-house IT for Higher Education

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Abstract

Cloud Computing is an excellent alternative for Higher Education in a resource limited setting. Universities should take advantage of available cloud-based application offered by service providers and enable their own user/student to perform business and academic tasks. In this paper, we will compare the cost between on-premise options and Cloud Computing. Two cost estimates will be created, the firstfor building and setting up IT infrastructure in-house in Federal University of Technology (FUTO), Nigeria while the second cost estimate will be for setting up IT in the cloud for the same Institution.This will enable us know the cost benefit cloud has over on-premise in setting up IT in Higher Educations.

Keywords: Cloud Computing, Higher Education, Cost Estimate, Virtualization, Cost Benefits.

1. INTRODUCTION

Institutions of higher education, in Nigeria and globally, are in the midst of historic times. Endowments at private and public institutions of higher education typically relied on as a source relief during financially troubled times, have experienced losses not seen since the Great Depression [1]. To backfill the deficit and in the climate of unprecedented budget cuts, institutions of higher education are invoking mass layoffs, steep tuition hikes, department closures, mandatory furloughs, and early retirements; even the threat of closures of universities and college systems looms, as evidenced by events in July 2011 that threatened to shutter the entire University System [2].

To address this financial shortfall during this economic downtown in higher education have resorted to a variety of cost-cutting measures, including significant cuts to information technology (IT) budgets. For example, for the 2009-2010 academic year, 50 % of IT leaders at universities and colleges in the U.S reported decreased funding in their IT budgets over the previous year. To compound the problem, the purchasing power of these IT dollars has decreased; IT costs have increased at a faster rate than the rate of inflation [3].

IT areas are perceived as significant cost centers, and for many administrators, despite the institution's reliance on technology in every aspect of its operation, it is difficult to accurately calculate the return-on-investment (ROI) from the cost of information technology; similarly, it is challenging to attribute to bigger cuts in the IT budget than many other areas on campus. The Campus Computing Project, which annually surveys IT leaders at institutions of higher education regarding critical issues in IT, reported that 42 % of colleges and universities experienced a budget cut in their IT centralized services for the 2010-2011 academic year. (As indicated earlier,

50 % has already taken cuts to their IT budgets the previous year.) Yet, in sharp contrast to this decrease in availability funding for IT services and support, the demand and expectations for IT services and resources on college and university campuses, staff and faculty are at an all-time high [4]. These increasing expectations have been ushered in largely by the growth of a new breed of incoming students. Cloud computing is revolutionizing the way Higher Education are implementing their information systems. Cloud computing has elevated IT to newer limits by offering the market environment data storage and capacity with flexible scalable computing processing power to match elastic demand and supply, whilst reducing capital expenditure [5]. As a result, Cloud adaptation is spreading rapidly and represents a new opportunity that Universities and Collages should not ignore given its profound impact.While there is no arguing about the staying power of the cloud model and the benefits it can bring to any organization, mainstream adaptation depends on several key variables falling into alignment that will provide users the reliability, desired outcomes, and levels of trust necessary to truly usher in a “cloud revolution.” Until recently, early adopters of cloud computing in the public and private sectors were the catalyst for helping derive technological innovation and increased adaptation of cloud-based strategies, moving us closer to this inevitable reality. Today, driven in large part by the financial crisis gripping the global economy, more and more organizations are turning towards cloud computing as a low-cost means of delivering quick-time-to-market solutions for mission-critical operations and services [6].

2. DEFINING CLOUD COMPUTING

Cloud computing, is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid [7]. It essentially means that applications are actually accomplished through the use of many computers that exist online, rather than on your local computer or web server. The name cloud computing was inspired by the cloud symbol that is often used to represent the Internet in flowcharts and diagrams [8].

Cloud Computing is a new paradigm in Information Technology (IT). There are several definitions of the Cloud, ranging from very broad as almost everything on the Internet to the very narrow only concerning Virtualization on servers only [9].

The basic idea is that anything that traditionally is possible in computing can be shifted to the cloud; Communication, scientific computing, word processing etc. In their research Vaquero and other researchers, proposed the following definition:

Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization [10].

A closer look at the above definition provides us with the concept of virtualization of resource. Looking at the word cloud, and already existing definitions the researcher propose the following definition: A cloud is first a platform born from the internetworking concept. It provides easily usable resources to its subscribers on a pay as you use basis or on a user agreement level in a situation where organizations come together to put up the cloud platform for their joint benefit. A cloud as the name imply can span over small to large geographical areas and even the entire globe as being seen today. Thus in summary a cloud is backbone that trunks resources to its users on an agreement level, as to usability and accessibility of available resources.

Today is the age of information technology. And according to kambil in the journal of business strategy, the facets of work and personal life are moving towards the concept of availability of everything online and understanding this trend, the big and giant web based companies like Google, Amazon, Salesforce.com came with a model named “Cloud Computing” the sharing of web infrastructure to deal with the internet data storage, scalability and computation [11]. A closer look at the concept of cloud computing brings us to a point of ease and availability of resources

without the need of necessary software platform or compilers to go about application development.

Current technological progress, particularly, in the past few decades, has demonstrated the need for performing more and more complex computations. To meet this requirement, large and complicated distributed systems have become essential. In Conventional IT environments, clients connect to multiple servers located on company premises. Clients need to connect to each of the servers separately. In Cloud Computing clients connect to the Cloud platform. The Cloud contains all of the applications and infrastructure and appears as a single entity to the user. Cloud Computing allows more efficient use of the resources by dynamically configuring resources to cater for changes in the demand for load.

2.1 The Cloud Vs the Internet

The term 'cloud' is analogical to 'internet. Cloud computing is an internet based computing technology where virtual servers provide infrastructure, platform, software, devices and other resources and hosting to customers on a pay-as-you-use basis [12]. Cloud computing customers do not own the physical infrastructure rather they rent the usage form a third-party cloud provider who owns the infrastructure.

The researcher sees the cloud as a concept that is similar to the internet in operation but not same as the internet in principle and usage. The cloud platform runs on the internet platform in that the distributed servers that host application are connected to the internet. In operation, the cloud makes use of its distributed database servers for application utilization and access using the internet as a route.

Basically, the internet is made up of servers located as various points in the globe. This servers range in their capabilities and availability and has some level of limitations compared to a cloud distributed server nature. Taking a bearing from the popular www.facebook.com platform that runs on the cloud and a typical webpage of a government agency in the Nigerian environment; the facebook platform has the ability to grant access at the same time to millions of users while the government agency website may not have such capability. This difference is as a result of the fact that the cloud is a more robust platform for interconnection as is runs on a distributed server concept whereas the website runs on a single server system and might not be able stand millions of hits at the same time from users.

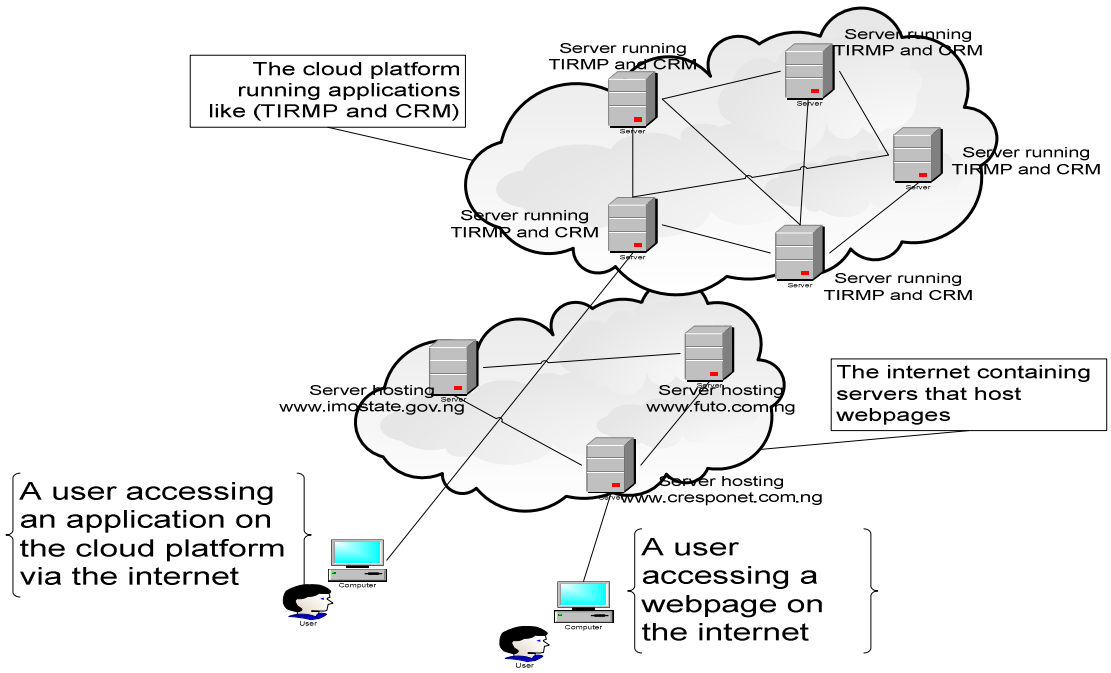

FIGURE 1: The Internet and the Cloud Platform [14].

2.2 Cloud Architecture

Cloud computing architecture consist of two components “the front end” and “the back end”. The front end of the cloud computing system comprises the client’s device (or it may be a computer network) and some applications are needed for accessing the cloud computing system. The back end refers to the cloud itself which may encompass various computer machines, data storage systems and servers. A group of these clouds make a whole cloud computing system. The whole system is administered via a central server that is also used for monitoring clients demand and traffic, ensuring the smooth functioning of the system. A special type of software called “middleware” is used to allow computers that are connected on the network to communicate with each other. Cloud computing systems also must have a copy of all its clients’ data to restore the service which may arise due to a device breakdown; making a copy of data is called redundancy [11].

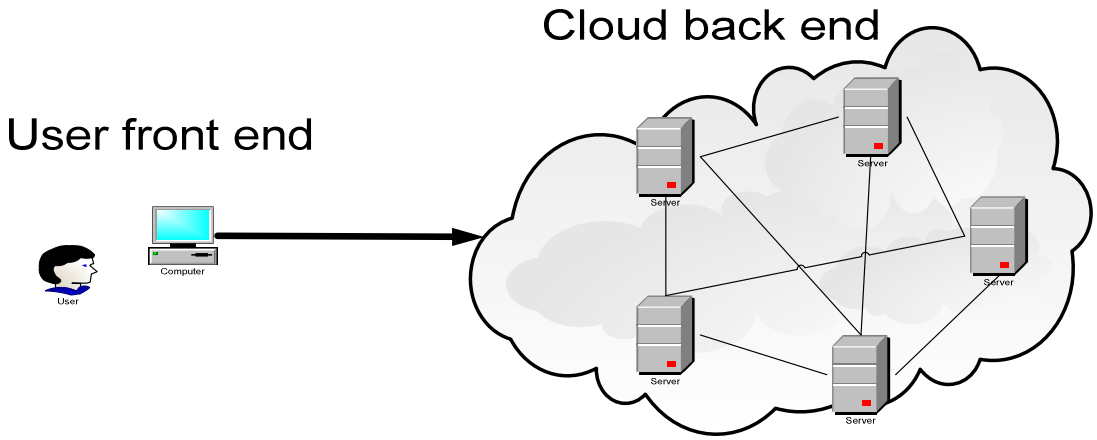

FIGURE 2: Diagram Illustrating the Cloud Architecture [14].

2.3 Cloud Deployment Models

Deploying cloud computing can differ depending on requirements, the following four deployment models proposed by the Dialogic Corporation have been identified, each with specific characteristics that support the needs of the services and users of the clouds in a particular ways. These models include Private cloud, Community cloud, Public cloud, and Hybrid cloud [13].

2.3.1 Private Cloud

The cloud infrastructure has been deployed, and is maintained and operated for a specific organization. The operation may be in-house or with a third party on the premises. The private cloud is also referred to as internal cloud or on-premise cloud, a private cloud intentionally limits access to its resources to service consumers that belong to the same organization that owns the cloud. In other words, the infrastructure is managed and operated for one organization only, primarily to maintain a consistent level of control over security, privacy and governance. Essential characteristics of a private cloud typically include:

- Heterogeneous infrastructure
- Customized and tailored policies
- Dedicated resources
- In-house infrastructure (capital expenditure cost model)
- End-to-end control.

2.3.2 Community Cloud

The cloud infrastructure is shared among a number of organizations with similar interests and requirements. In this case, organizations come together to setup a cloud for their common interest. Each organization has access to the platform based on their contributions to the overall setup of the cloud system. This may help limit the capital expenditure costs for its establishment as the costs are shared among the organizations. The operation may be in-house or with a third party on the premises. This deployment model typically refers to special-purpose cloud computing environments shared and managed by a number of related organizations participating in a common domain or vertical market.

2.3.3 Public Cloud

The cloud infrastructure is available to the public on a commercial basis by a cloud service provider or in some cases the government. This enables a consumer to develop and deploy a service in the cloud with very little financial outlay compared to the capital expenditure requirements normally associated with other deployment options. It is also known as external cloud or multi-tenant cloud, this model essentially represents a cloud environment that is openly accessible. It generally provides an IT infrastructure in a third-party physical data center that can be utilized to deliver services without having to be concerned with the underlying technical complexities.

Essential characteristics of a public cloud typically include:

- Homogeneous infrastructure
- Common policies
- Shared resources and multi-tenant
- Leased or rented infrastructure; operational expenditure cost model

- Economies of scale

Note that public clouds can host individual services or collections of services, allow for the deployment of service compositions and even entire service inventories.

2.3.4 Hybrid Cloud

The cloud infrastructure consists of a number of clouds of any type, but the clouds have the ability through their interfaces to allow data and/or applications to be moved from one cloud to another. This can be a combination of private and public clouds that support the requirement to retain some data in an organization, and also the need to offer services in the cloud.

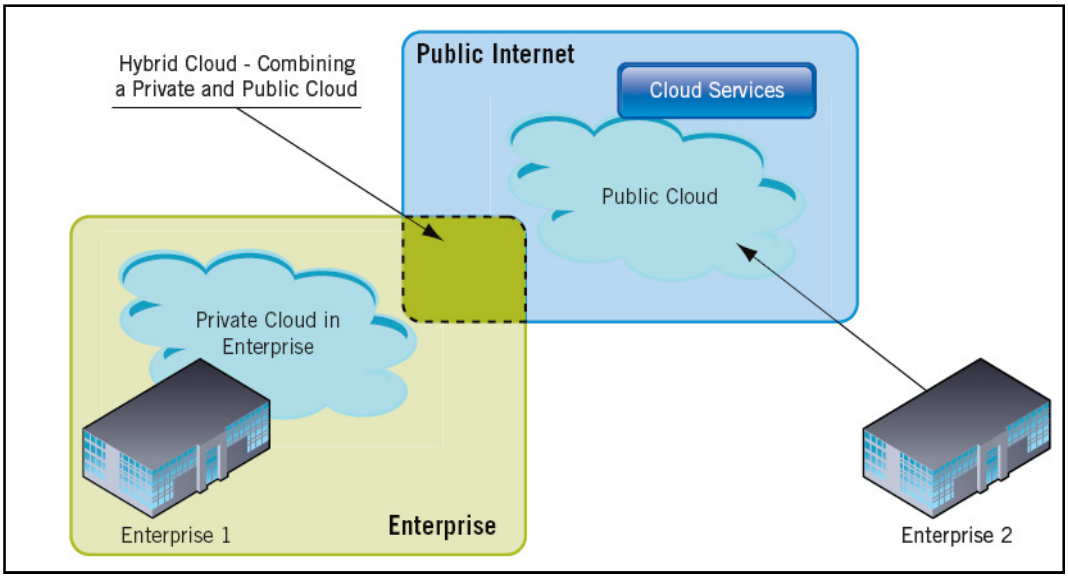

FIGURE 3: Public, Private, and Hybrid Cloud Deployment.

2.4 Cloud Services

Cloud computing services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).

A cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic, meaning that a user can have as much or as little of a service as they want at any given time; and service is fully managed by the provider (the consumer needs nothing but a personal computer and internet access). Significant innovations in virtualization and distributed computing, as well as improved access to high-speed Internet and a weak economy, have accelerated interest in cloud computing.

A cloud can be private or public. A public cloud sells services to anyone on the Internet. Currently, Amazone Web Services is one of the largest public cloud providers.) A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services.

2.4.1 Infrastructure as a Service

Infrastructure-as-a-Service like Amazon Web Services provide virtual server instance API to start, stop, access and configure their virtual servers and storage. In the enterprise, cloud computing allows a company to pay for only as much capacity as is needed, and bring more online as soon

as required. Because this pay-for-what-you-use model resembles the way electricity, fuel and water are consumed; it's sometimes referred to as utility computing.

2.4.2 Platform as a Service

Platform-as-a-Service in the cloud is defined as a set of software and product development tools hosted on the provider's infrastructure. Developers create applications on the provider's platform over the internet. PaaS provides many use API's, website portals or gateway software installed on the customer's computer. Force.com, (an outgrowth of Salesforce.com) and GoogleApps are examples of PaaS. Developers need to know that currently, there are not standards for interoperability or data portability in the cloud. Some providers will not allow software created by their customers to be moved off the provider's platform.

2.4.3 Software as a Service

In the Software-as-a-Service cloud model, the vendor supplies the hardware infrastructure, the software products and interacts with the user through a front-end portal. SaaS is a very broad market. Services can be anything from Web-based email to inventory control and database processing. Because the service provider hosts both the application and the data, the end user is free to use the service from anywhere.

3. COST ESTIMATE: CLOUD VS IN-HOUSE

We will be comparing the initial cost of building and setting up IT in-house and that of cloud in a resource limited setting.

3.1 The Work Breakdown Structure (WBS) forIn-House IT

The list below shows aWork Breakdown Structure (WBS) for building and setting up in-house IT in Federal University of Owerri, (FUTO) Nigeria:

- Project Management
  - Project Manager
  - Project Team Members
- Staffing
  - Database Administrators
  - Network Administrators
- Hardware
  - Laptops
  - Servers
  - Cisco Routers
  - Air Conditioners
  - Back-Ups
- Software
  - Licensed Software
  - Software Development
- Service Providers
  - Installations
  - 1GBps Dedicated ASDN – Broadband Internet Subscription
- Hosting
- Testing
- Training and Support
- Reserves

3.2 Sample Cost Estimate for In-HouseIT

This is the cost estimate for building and setting up in-house IT in FUTO.

3.2.1 *Project Management:*

The budget experts for this project suggested using a labor rate of:

i. 8 hours per day and 25 days/month giving a total working average of 200 hours (8 x 25)
ii. 800 per hour for the project manager
iii. 300 per hour for each team member
iv. Based on the working average of 200 hours per month. The total hours for the project manager per annum under this category are 2400 (200 x 12).
v. Costs are also included for the twenty project team members working an average of 200 hours per month each. The total hours for a team of twenty members per annum will be 48000 (20 x 200 x 12).

3.2.2 Staffing:

i. □400 per hour for each Database Administrator (DBA)
ii. □350 per hour for each Network Administrator
iii. Average working hour for each DBA is 200 hours per month. The total hours for 5 DBAs for nine months will give 9000 (5 x 200 x 9)

3.2.3 Hardware:

i. *Laptops:* Twenty (21) laptops estimated at □150000 per unit. One for each team members and the project manager.
ii. *Servers:* Ten (10) Servers estimated at □250000 per unit, two for each faculty and we have a total of five faculties in FUTO. Each faculty will have one front end server and one back end server.
iii. *Cisco Router:* Two (2) routers estimated at □300000 per unit. These routers will be enough to serve the entire institution.
iv. *Air Conditions:* A total of fifteen (15) Air Conditions will be required. It will be shared three per faculty and estimated at □120000 per unit.
v. *Back-Ups:* Five (5) Back-Ups will be built and setup for each faculty which is estimated at □300000 per unit.

3.2.4 Software:

i. *Licensed Software:* Licensed cost of the Oracle software Edition for the backend server include:
□200000 Oracle Standard Edition.
□1 000000 Oracle Enterprise Edition.
Since the Student Course Registration and Result Assessment Application is going to be deployed for the whole Schools in FUTO and there is also a strong probability that future applications such as accounting software's, information systems and more will be to deployed in FUTO, Oracle Enterprise Edition will be the recommended software to purchase. Selected choice of cost □1000000.
ii. *Software Development:* Based on rough estimate the cost of software development will not be more than □5000000.

3.2.5 Service Providers:

i. *Installations:* MTN will provide the Dedicated ADSL connection with an installation fee that will be based on survey but based on similar projects will be estimated to be □1000000 for fiber optics installation.
ii. *1GBps Dedicated ASDN - Broadband Internet Subscription:* The cost for 1Gbps is estimated at □818/hour. Total number of hours for 9 months will be 7344 hours (306 days x 24 hours)

3.2.6 Hosting:

The estimate for hosting based on similar projects will cost □100000

3.2.7 Testing:

Based on similar projects, testing will be estimated as 10 percent of the total hardware and software cost.

3.2.8 Training and Support

Based on similar projects, testing will be estimated on per-trainee bases, plus transportation cost. The cost per trainee will be □500/hour, and transportation will be □100/day/person for the instructors and project team members. Training is meant to be conducted twice in a week for 2 hours/day. It is estimated that there will be a total of 40 training days. Total training counts for twenty members will be 800 (40 x 20). Total training hours will be 1600 (2 x 800)

3.2.9 Reserves:

As directed, reserves will be estimated at 10 percent of the total estimate.

	# Units/Hrs	Cost/Unit/Hrs	Sub Totals	WBS Level 1 Totals	% of Total
WBS ITEMS					
PROJECT MANAGEMENT				16320000	28.91
Project Manager	2400	800	1920000		
Project Team Member	48000	300	14400000		
STAFFING				9900000	17.54
Database Administrators	9000	400	3600000		
Network Administrators	18000	350	6300000		
HARDWARE				9550000	16.92
Laptops	21	150000	3150000		
Servers	10	250000	2500000		
Cisco Routers	2	300000	600000		
Air Conditions	15	120000	1800000		
Back-Ups	5	300000	1500000		
SOFTWARE				6000000	10.63
Licensed Software			1000000		
Software Development **			5000000		
SERVICE PROVIDERS				7007392	12.41
Installations			1000000		
1Gps Dedicated ASDN Broad-band Internet Subscription	7344	818	6007392		
HOSTING				100000	0.18
TESTING (10% of the total hardware and software cost)				1555000	2.75
TRAINING AND SUPPORT				880000	1.56
Training cost	1600	500	800000		
Transportation cost	20	4000	80000		
RESERVES (10% of total estimate)				5131239	9.09
TOTAL COST OF PROJECT				56443631	100

TABLE 1: This Table shows the Sample Cost Estimate for setting up In-House IT in FUTO.

3.3 The Work Breakdown Structure (WBS) Cloud IT In

The Work Breakdown Structure (WBS) is shown below:

- Project Management
  - Project Manager
  - Project Team Members
- Staffing
  - Database Administrators
  - Hardware
  - Laptops
- Software
  - Software Development
- Service Providers
  - Installations
  - 1GBps Dedicated ASDN - Broadband Internet Subscription
- Testing
- Training and Support
- Reserves

3.4 Sample Cost Estimate for Cloud IT

This is the cost estimate for building and setting up IT in the cloud.

3.4.1 Project Management:

The budget experts for this project suggested using a labor rate of:

i. An average worker works 8 hours/day and 25 days/month giving a total of 200 hours (8 x 25)
ii. □800/hour for the project manager
iii. □300/hour for each team member
iv. Based on the working an average of 200 hours per month. The total hours for the project manager per annum under this category are 2400 (200 x 12).
v. Costs are also included for the five project team members working an average of 200 hours per month each. The total hours for a team of twenty members per annum are 12000 (5 x 200 x 12).

Note: Building applications using cloud computing technology is faster and makes collaboration and team work easer and transparent hence, fewer number of team members can be used to achieve more than would have with in-house development.

3.4.2 Staffing:

i. □400/hour for each Database Administrator (DBA)
ii. Average working hour for each DBA is 200 hours per month. The total hours for 5 DBAs per annum will give 12000 (5 x 200 x 12)

Note**:** Network Administrators will not be required because there are no servers to be managed when using a cloud platform to manage IT recourses.

3.4.3 Hardware:

Laptops: Twenty (6) laptops estimated at □150000 per unit. One for each team members and the project manager.

3.4.4 Software:

Software Development: Development in the cloud is faster and cheaper because there are fewer line codes of codes to write hence, based on rough estimate the cost of software development will not be more than □2000000.

3.4.5 Service Providers:

i. Installations: MTN will provide the Dedicated ADSL connection with an installation fee that will be based on survey but based on similar projects will be estimated to be □1000000 for fiber optics installation.

ii. 1GBps Dedicated ASDN - Broadband Internet Subscription: The cost for 1Gbps is estimated at □818/hour. Total number of hours for 9 months will be 7344 hours (306 days x 24 hours)

3.4.6 Testing:

Based on similar projects, testing will be estimated as 10 percent of the total hardware and software cost.

3.4.7 Training and Support

The Cloud Platform we will be using provide a lot of hands on video tutorials hence fewer trainers will be required which reduced from 20 to 5 one for each faculty.

Based on similar projects, testing will be estimated on per-trainee bases, plus transportation cost. The cost per trainee will be □500/hour, and transportation will be □100/day/person for the instructors and project team members. Training is meant to be conducted twice in a week for 2 hours/day. It is estimated that there will be a total of 40 training days. Total training counts for twenty members will be 200 (40 x 5). Total training hours will be 400 (2 x 800).

3.4.8 Reserves:

As directed, reserves will be estimated at 5 percent of the total estimate due to lesser risk involved in cloud computing technology.

	# Units/Hrs	Cost/Units/Hrs	Sub Totals	WBS Level 1 Totals	% of Total
WBS ITEMS					
PROJECT MANAGEMENT				5520000	24.01
Project Manager	2400	800	1920000		
Project Team Member	12000	300	3600000		
STAFFING				4800000	20.88
Database Administrators	12000	400	4800000		
HARDWARE				900000	3.92
Laptops	6	150000	900000		
SOFTWARE				2000000	8.70
Software Development **			2000000		
SERVICE PROVIDERS				8165680	35.52
Installation			1000000		
1 Gps Dedicated Internet Subscription	8760	818	7165680		
TESTING (10% of the total hardware and software cost)				290000	1.26
TRAINING AND SUPPORT				220000	0.96
Training cost	400	500	200000		
Transportation cost	5	4000	20000		
RESERVES (5% of total estimate)				1094784	4.76
TOTAL COST OF PROJECT				22990464	100

TABLE 2: This Table shows the Sample Cost Estimate for Setting up Cloud-Based IT in FUTO.

4. RESULT

Table 3 states the cost estimate for the various items in the work breakdown structure used to deploy IT on-premise and in the Cloud for FUTO.

WBS ITEMS	ON-PREMISE	CLOUD
Project Management	16320000	5520000
Staffing	9900000	4800000
Hardware	9550000	900000
Software	6000000	2000000
Service providers	7007392	8165680
Hosting	100000	0
Testing	1555000	290000
Training	880000	220000

TABLE 3: EstimatedCost ofIT infrastructure between On-Premise and Cloud.

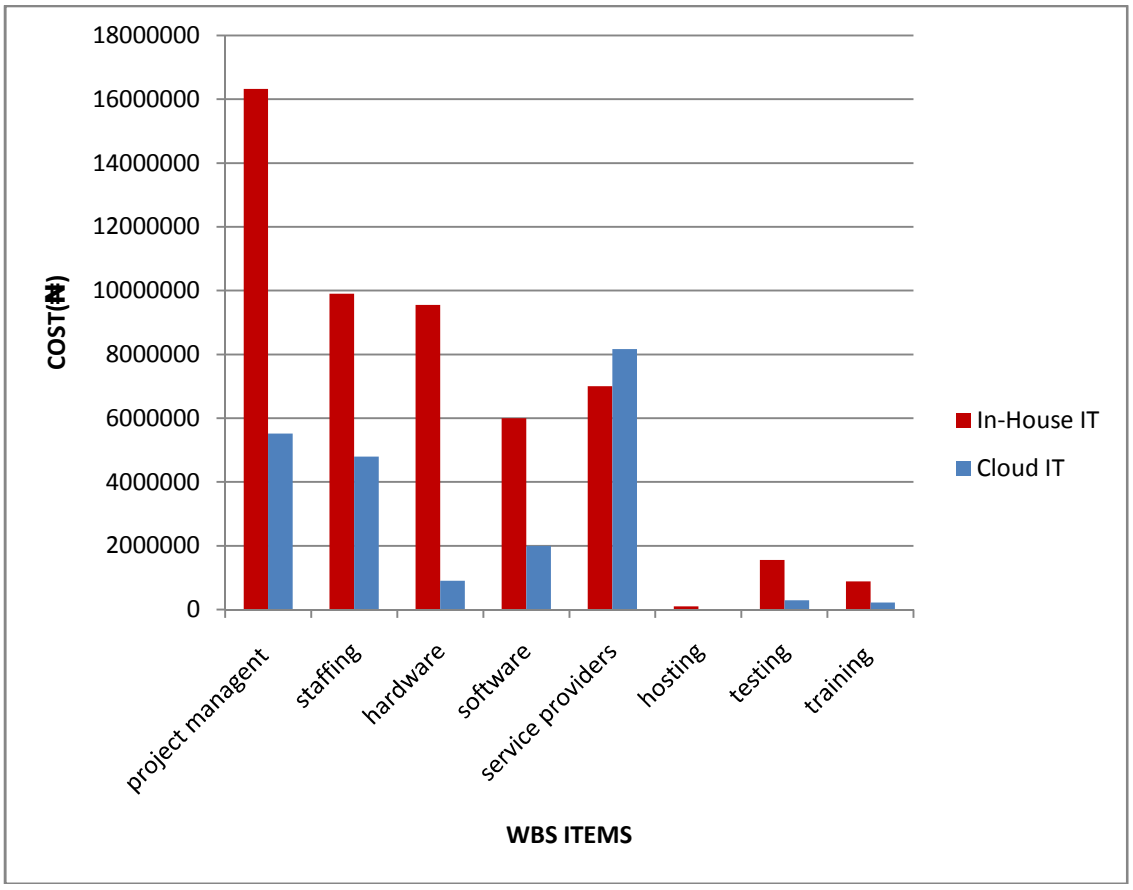

FIGURE 4: Cost versus WBS Items.

The chart in Figure 4 compares the difference between Cost involved in deploying IT On-Premise and that of cloud. However, we can see that the cost of each of the WBS Items required for the Cloud is lesser than that of On-Premise except that of the Service Providers; this is because to enjoy the benefits of the cloud a dedicated network is required to provide constant internet access. Project Management Team, Staffing and Hardware cost is drastically reduced with cloud technology because both the acquisition and maintenance of the IT Infrastructure is handled by the cloud providers. Software development and deployment is done rapidly in the Cloud such that one does not have to start from the scratch. Hence developers can come up with a fully functional application in a very short time also one does not have to pay for SoftwareLicenses making the costing for software development cheaper in the cloud. The cloud does not require any extracost for hosting because the PaaS provides a platform to customize and build applications on the fly all you need to do is just to pay the monthly subscription fee which was included as part of the software cost.Testing applications in the cloud is also less expensive because an organization does not need to purchase separate dedicated servers for testing their applications. Cloud Providers provide on line support, webinars, video tutorials and materials hence fewer trainers is required reducing the training cost drastically.

4.1. Percentage Difference

Comparing the percentage difference of Cloud vs. In-house, the total cost of In-house project in TABLE1 is □56443631 while the total cost of Cloud-based project in TABLE2 is □22990464.
[(56443631 – 22990464) / 56443631] x 100 = 59%.This result shows that Cloud Computing has a way of greatly reducing Capital Expenditure Cost.

5. CONCLUSION

Building and setting up IT infrastructure for an Institution in Nigeria using cloud-based service reduces IT cost by 50 - 60%, while lowering the employee learning curve and minimizing equipment investments.One of the primary goals for Universities is to reduce the amount of time and money required to procure, provision, and install new hardware systems [15]. Cloud-Computing is also future-proof, as it is up to the provider to keep infrastructure up to date and disaster-resistant, as a provider's equipment is more likely to withstand flood than the typical Higher Education in Nigeria.

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ERP Implementation Success Factors in Saudi Arabia

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Abstract

A review of the literature on successful implementation of ERP reveals that there are many case studies undertaken by researches, but very few have empirically examined the success factors of ERP implementation. While most of those empirical studies were undertaken in Western countries, very few had examined the implementations in Middle Eastern countries and none in Saudi Arabia. Factors and challenges of ERP implementation in developing countries differ from those of Western countries. Hence a gap in the literature that examines Middle Eastern countries exists. This study is motivated to fill such gap by going beyond case study and boundaries of Western counties to empirically examine the determinants of successful ERP implementation in Saudi Arabia. The main purpose of this study is to examine the influence of some critical factors on successful implementation of ERP.

Keywords: ERP, ERP Success factors, Saudi Arabia, Enterprise Resource Planning.

1. INTRODUCTION

Enterprise Resource Planning (ERP) is an enterprise-wide software solution that integrates and automates business functions of an organization. As an integrated system, ERP encompasses all the procedures and functions in a single framework [1]. It synchronizes the planning of processes across all functions within an organization [2]. Some of the functions that are integrated by the latest generations of ERP software packages include those of finance, accounting, human resources, operations, supply chains, among others [3]. To stay competitive, organizations must hence make concerted effort to improve their business practices and procedures [4], shorten their processes and enhance their productivity among others. To achieve these intents, organizations have been embracing ERP [5].

Many researchers [6-8] view ERP applications as information systems packages that institutionalize sharing of organizational data. Other researchers [9] describe ERP as an integrated, customized, packaged software-based system that handles the majority of an enterprise's system requirements in all functional areas such as finance, human resources, manufacturing, sales and marketing.

In spite of the varied definitions of ERP, there are similar characteristics that are common to all ERP systems. One distinguishing feature of ERP is that it is a software package of different modules. While each of these modules is business specific, the function of each module is linked by the ERP system to one another and to the whole database. This integration of the modules

allows managers and other users direct access to real time operations and it also helps to eliminate counterproductive processes and cross functional coordination problems [10].

It is not disputed in the literature that ERP implementations bring value to the organization. In spite of all the purported benefits of ERP, its implementation is costly, complex, and many organizations fail to realize the expected benefits [3, 11]. Companies lost not only invested capital in ERP software, but also a major portion of their businesses. Further, the literature is abounding of the unsuccessful implementation of ERP, with many organizations filing for bankruptcy protection and others deciding to abandon the whole implementation of the projects [4]. A number of studies explore the possible factors that foster ERP implementation success [12, 13]. Some of the important factors that impact successful ERP implementation include but not limited to business process re-engineering, top management support, vender support, consultant competence, user support, IT capability, and project leadership.

2. BACKGROUND AND PROBLEM STATEMENT

A review of the literature on successful implementation of ERP reveals that there are many case studies undertaken by researches, but very few have scientifically (empirically) examined the success factors of ERP implementation [4]. Moreover, while most of those empirical studies were undertaken in Western countries, very few had examined the implementation in Middle Eastern countries and none in Saudi Arabia.

Factors and challenges of ERP implementation in developing countries differ from those of Western countries. Hence a gap in the literature that examines Middle Eastern countries exists. This study is motivated to fill such gap by going beyond case study and boundaries of Western counties to empirically examine the determinants of successful ERP implementation in Saudi Arabia. The main purpose of this study is to examine the influence of some critical factors on successful implementation of ERP.

The importance of identifying critical factors for successful implementation of ERP cannot be overemphasized. The results of this study will complement findings of those studies from Western countries by giving an insight of the critical success factors of ERP implementation in developing countries and Saudi Arabia in particular.

The study will equally be of practical significance to upper management of organizations and other stakeholders in their effort to adopt ERP successfully. The findings of the study will equally fill the gap in the literature and provide empirical insight of the success factors for implementing ERP. The results of the study are, therefore, important to various stakeholders.

Being an empirical study, a survey study will be administered to the respondents. The following research questions will be studied:

1. What is the level of successful implementation of ERP in Saudi Arabia?
2. What is the extent of the internal and external critical success factors?
3. What is the impact of the identified success factors on the ERP implementation success?
4. Does the degree of ERP implementation success and critical success factors differ among demographics?

Based on these research questions, the following hypotheses were devised:

H1. The perceived vendor support is positively associated with ERP success
H2. The perceived consultant competence is positively associated with ERP success
H3. Business process re-engineering is positively associated with ERP success
H4. The competence of the ERP team is positively associated with ERP success
H5. ERP project manager is positively associated with ERP success
H6. Top management support is positively associated with ERP success
H7. User support is positively associated with ERP success

3. CONCEPTUAL OR THEORETICAL FRAMEWORK

The factors of successful implementation of ERP software are divided into internal and external factors. This paper proposed a conceptual model which was developed based on these internal and external factors and portrays the relationship of the study variables as shown in Figure 1.

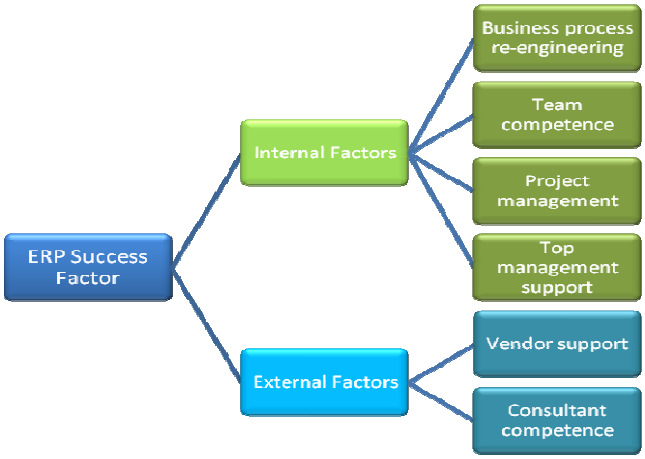

FIGURE 1: ERP Success Factors.

Some assumptions have been made with respect to this study. First, it is assumed that the respondents will answer the questions on the questionnaires objectively and none of the respondents is aware of or influenced by other respondent(s). Second, it is assumed that the responses of the sample are representative of the whole population. Finally, the study being cross-sectional in nature takes only a snapshot measurement of ERP success factors and ERP implementation success. The study is not designed to measure the ERP success factors and ERP implementation success at different time interval. Thus, the result of the study will replicate the perceptions of the respondents at the time of the survey for the study.

3.1 Critical Success Factors (CSF)

Critical success factors (CSF) are very important in ERP implementation because they provide clear guidance to practitioners on where to focus and allocate resources reasonably in planning an ERP project. The need to understand CSFs is also critical owing to the high failure rate of ERP implementation. Thus, different researches and field experiences maintained that there could be different critical issues in ERP implementation [14]. For the purpose of this study, the critical success factors are broadly divided into two, external and internal (organizational) factors.

3.2 External Factors

Somers and Nelson [15, 16] identify vendor support and consultant competence as needed external CSFs for ERP project implementation success. Considering the fact that ERP systems are complex packages with a level of functional interoperability, organizations tend to rely on external expertise for help in developing, implementing, and maintaining such systems [3]. An organization, adopting ERP, tends to enter into a lifelong arrangement with the external providers of such software [3].

3.2.1 Vendor support

Adoption of ERP involves lifelong commitment for organizations [17]. This is because newer modules and versions of the ERP systems must continually be installed or updated to improve the fit between the organizations and the system. For the reason that most companies purchase their ERP packages from foreign ERP vendors, the need for vendor support is more pronounced [18]. Thus, vendor support is needed throughout the period of the ERP existence. As an important factor for ERP systems implementation, vendor support

often includes extended technical assistance, emergency maintenance, updates, service responsiveness and reliability, services responsiveness and user training [15].

The relationship between the vendor and ERP adopting organization should be strategic in nature in such a way that vendor enhances the organization's competitiveness and efficiency [19] and the partnership seems more critical during the earlier stages of implementation [19]. The success of ERP project as a result of vendor support is also more pronounced if a fit exist between the software vendor and user-organization. In this regards, [20] advised that such fit is positively related to ERP implementation success. Since vendor supports play a crucial part in shaping the ultimate outcome of the implementation, it can hence be posited that:

H1: Vendor support has a positive impact on ERP implementation success in Saudi Arabia.

3.2.2 Consultant Competence

What makes the need for such consultants stronger in ERP implementation than in another project is due to the fact that ERP implementation project involves a wide range of skills in addition to technical implementation knowledge [21]. Hence, consultants serve as both knowledge providers as well as facilitators during the implementation [22, 23].

The consultants who are normally from ERP vendors and ERP consulting companies are experienced and they help the ERP implementing company not only during but even after the ERP implementation process. ERP consultants also play mediating role at the post-implementation stage by transferring their knowledge on the effective use of the ERP system to the focal organization [1].

The role of consultant in ERP implementation was identified by number of researchers as an important factor for the success of the ERP Implementation [24, 25]. Consultant competence can be viewed as an external knowledge stock, which provides the needed knowledge to the ERP adopting firms [8]. This is because when a client works with competent consultants the knowledge required for ERP implementation should be more effectively transferred to the client than when working with less competent consultants [8]. Markus and Tanis [3] highlighted the need to depend on competent consultants who possess experience in system implementation and can effectively support their clients [2]. Thus, it can be hypothesized that:

H2: Consultant competence has a positive impact on ERP implementation success in Saudi Arabia.

3.3 Internal (Organizational) Factors

In addition to external factors, ERP projects are affected by internal (organizational) factors:

3.3.1 Business Process Re-Engineering

An ERP system includes reengineering the existing business processes into the best business process standard and a number of researchers have elucidated the need for the business process reengineering during the implementation of an ERP system [26, 27]. It is often argue that one of the chief reasons why ERP systems fail is that organizations simply underestimate the extent to which they have to change and re-engineer the existing business processes in order to accommodate the systems. Thus, it is inevitable that business process is molded to fit new system. Organizations should be willing to change their business process to fit the new system with minimal customization.

Prior studies asserted that the more willing an organization is to change, the more successful the implementation of its ERP systems [28]. Hence, a number of researchers have identified business process reengineering as a critical success factor [15, 29, 30] and adoption of ERP could be positively associated with change in business process, it can hence be hypothesized that:

H3: Business process reengineering has a positive impact on ERP implementation success in Saudi Arabia.

3.3.2 ERP Team Competence

As ERP project team members are generally responsible for creating the overall implementation schedule for ERP project, and for conducting various implementation activities [2] (Tsai et al., 2005), Umble et al [31] suggest that ERP implementation teams should be composed of people possessing skills, past accomplishments, good reputations, flexibility, and the ability to be entrusted with critical decision making responsibility.

Thus, ERP project team member competence refers to the amount of knowledge and understanding that various team members have with respect to the ERP system as well as the business operation process [2]. Hence, the best choice need to be made that involves cross-functional members [32]. The team members should also have not only technical knowledge, but should also be aware of the business processes of their organizations as well as have background knowledge on the industry's best practices [15, 33]. Other issue is possible the extent to which the team is empowered by management to take responsibility on making critical decisions [13]. Thus the following hypothesis is developed:

H4: ERP Project Team Member Competence has a positive impact on ERP implementation success.

3.3.3 ERP Project Leadership

An ERP project manager can be seen as one who plans, leads and controls an ERP project and promotes good working relationships across the project [34]. Leadership has been examined as one of the most critical factors for organizations investing in ERP implementation. ERP project manager leadership is referred to as the extent to which the ERP project manager sets the vision and the direction for the business, harnesses the energy and creativity of employees to exploit the technological capabilities of an ERP system [26, 34, 35].

Some authors consider knowledge, skills, abilities, and experience or rather sound leadership ERP project manager to be the single most decisive element in successful ERP adoption. Since strong and committed leadership from the project leader is essential to the success of ERP implementation [36], it can hence be proposed that:

H5: ERP project manager leadership has a positive impact on ERP implementation success in Saudi Arabia.

3.3.4 Top Management Support

Shanks et al [37], argues that top management support is regarded as positive commitment, enthusiasm, and support of senior management for ERP project. Top management support in ERP implementation is seen to have two main facets that include providing leadership and necessary resources. This is because during a successful ERP implementation, top managers need not only to continuously monitor the progress of the project and provide direction to the implementation team, but also champion ERP within the organization and allocate sufficient required resources. In addition, top management provides the strategic direction of the organization. However top managers involvement seems stopped as soon as they allocated the resources. Some organizations even ignore top management support at the post-implementation stages [38-40]. For the whole period of ERP implementation, the support of top management is required.

Many a study had proved that top management plays a critical success factor of ERP implementation [17, 41, 42] empirically proved that strong and committed leadership at the top management level is essential to the success of an ERP implementation. Also, practical experiences of some companies affirmed this assertion. Since top management support is consistently identified as one of the most important factors for ERP implementation success[9, 17, 31, 33, 43-45], the following hypothesis can therefore be posited:

H6: Top management support has a positive impact on ERP implementation success in Saudi Arabia.

3.3.5 User Support

The need for user support is important in ERP implementation because large systems development requires user input in order to be successful (Stewart et al., 2000). It also includes both positive attitudes toward the system and willingness to participate in the implementation as well as accept the change brought about by the system. Huang et al. [46] identify failure to get user support as the major risk factors in ERP projects. This is because lack of support from the users has the tendency to hinder the successful implementation of ERP initiative [47]. Based on this, it can be hypothesized that:

H7: User support has a positive impact on ERP implementation success in Saudi Arabia.

4. METHODOLOGY AND RESEARCH DESGIN

Similar to previous related studies [48, 49], this research adopts quantitative approach in a bid to examine the determinants of successful implementation of ERP in Saudi Arabia. The success factors were measured using a validated instrument.

As a research design is influenced primarily by the research purpose and questions [50], this research focused on quantitative research method and hence a survey is used with a typical data collection method [50]. Since this quantitative study is based on cause and effect, the independent variable and dependent variable are ERP critical success factors and ERP implementation success respectively. Two constructs, ERP implementation success and ERP critical success factors, are involved in this study.

The population of this study is organizations of varying sizes, activities, ownership and from different regions of Saudi Arabia. As a field survey is used in obtaining the data, a sample size of 150 organizations were chosen in this study. Thus, a sample of 150 employees was drawn to whom surveys were administered and out of such questionnaires delivered, 74 were returned, representing 49.3% usable response rate which is considered quite favorable compares to response rates for other recent similar studies [49] and [48] which have response rates of 10.6% and 18% respectively.

With respect to the organizational activities, most of the respondent's firms (62 percent) partake in manufacturing activities. However, 28 percent are in service industry and the remaining 9.9 percent are involved in both activities. Pertaining organizational ownership, more than half of the firms (59.2 percent) are jointly owned partly by government and partly by private individuals. About one quarter (28.2 percent) of the respondents firms are privately owned, the reaming 12.7 are owned by government. Table 1 shows the different demographics of the respondents.

	Valid responses	Percent	Cumulative Percent
Occupational Level			
Top Manager	11	15.5	15.5
Middle manager	18	25.4	40.8
Supervisor	17	23.9	64.8
Other	25	35.2	100.0
Organizational Activities			
Manufacturing	44	62.0	62.0
Services	20	28.2	90.1
Both	7	9.9	100.0
Organizational Ownership			
Private	20	28.2	28.2
Government	9	12.7	40.8
Joint	42	59.2	100.0
Organizational Size (Employees)			
Less than 100	9	12.7	12.7
100-500	28	39.4	52.1
More than 500	34	47.9	100.0
Organizational Experience			
5 Years or Less	34	47.9	47.9
6- 10 Years	9	12.7	60.6
Over 10 Years	28	39.4	100.0

TABLE 1: Respondents Demographics.

5. INSTRUMENTATION

In this study, the independent variable, ERP critical success factors, has single construct with seven dimensions. Further, the dependent variable, ERP implementation success, also has a single construct.

The questionnaire administered was divided into three sections requesting the respondents' opinions on the extent of ERP critical success factors; ERP implementation success and demographic data. Six items were used to measure ERP implementation success. The respondents were asked to indicate their perception of those items with respect to ERP implementation in their organizations. A rating scale of 1 to 5 was used in the questionnaire with descriptors strongly disagree, disagree, neutral, agree and strongly agree respectively. The items and their descriptors were adapted from [40].

With respect to the ERP critical success factors construct, six out of the seven dimensions of the construct were adapted from [49] . These dimensions are vendor support, consultant competence, ERP project team member competence, ERP project manager leadership, top management support and user support. The final dimension, business process re-engineering, was adapted from [48]. The scale for all the seven dimensions of the ERP critical success factors construct are on 5 Likert scale ranging from 1 to 5 with the extreme descriptors as strongly disagree and strongly agree. Finally, questions relating to both the characteristics of the respondents and their organizations included the demographic profile of the respondents.

The Statistical Package for Social Science (SPSS) was used to analyze the data collected from the questionnaires. The statistical methods used were the descriptive statistics (such as the ratios, mean, standard deviation SD…etc) and correlation as the inferential analysis method of

testing the study hypotheses. The descriptive statistics used include Analysis of Variance (ANOVA), one-sample test as well as graphs and tables.

5.1 Reliability

Cronbach alpha has been suggested to be the preferable measure of index reliability. The scales used in this study were checked for their internal consistency. Though there is no theoretically acceptable value for the reliability measure, but [51] had suggested Cronbach alpha of 0.70 as an acceptable value for scale development. A factor could also be considered reliable even if the Cronbach alpha is not up to 0.70, but if it is close to it [52, 53].

5.2 Validity

Various items that represent each dimension of the study constructs were analyzed to see if they are properly assigned to the appropriated scale. Factor analysis was adopted in this study because it is the most widely used technique to assess the construct validity of an instrument. In order to enhance the validity and reliability of the study variables in a bid to check the internal consistency of the study scales, factor and reliability analyses were undertaken respectively.

Factor analysis with varimax rotation was utilized to analyze the questionnaire variables. The factor analysis detected relevant factors for (1) ERP implementation success and (3) the seven dimensions of ERP critical success factors. Two criteria were used to identity factor scales. First, all scale items that loaded less than 0.50 were removed. Second, the construct would be represented by the factor that has the highest value. Significant results of the factor analysis were depicted in Table 2.

For ERP implementation success, all the items were found to be correlated with the factorial groups produced with the factor loading more than 0.50. Out of the 6 items, two factors emerged. Thus, one factor which has the highest eigenvalue was selected as depicted in Table 2. From the table, it is evident that the Cronbach's alpha of the construct, ERP implementation success is 0.838. Since according to the guideline of [51] the value of 0.7 or above is an acceptable reliability coefficient, hence the construct has exhibited adequate reliability.

Regarding the seven dimensions of ERP critical success factors, a single factor emerged for both vendor support and user support and their Cronbach's alpha as can be seen in Table 3 are 0.856 and 0.876 respectively. Thus both vendor support and user support constructs are considered reliable since their Cronbach's alphas meet the guideline of [51] cutoff value of 0.7 or above.

Moreover, out of the 5 items of consultant competence, 5 items of business process re-engineering and 5 items of top management support, two factors emerged for each of them. Thus, as can be seen in Table 3, single factors with the highest eigenvalue were selected for each of the three dimensions. And based on the result of the reliability test, the Cronbach's alphas for the consultant competence, business process re-engineering and management support are 0.880, 0.711 and 0.666 respectively. Thus, these factors could all be considered reliable. Though the Cronbach's alpha of consultant competence is 0.666 which is not up to 0.70, the factor could still be considered reliable since it very close to .70 [52, 53].

However, the Cronbach's alphas of the remaining two dimensions of the ERP critical success factors, ERP project team member competence and ERP project manager leadership, are 0.571 and 0.487 respectively. Thus, since these amount are quite below the [51] cutoff value of 0.7, the reliability of both factors were not confirmed. Hence, these factors were dropped and were not considered in the analysis of results.

Construct name	Item	Factor*
ERP Implementation Success		
	The cost of ERP project was significantly higher than the expected budgets.	0.855
	There is no match between ERP systems and specific planned/objectives	0.719
	User's attitudes towards ERP are negatives	0.859
	ERP systems did not match user's expectations	0.854
	Variance explained (%)	***50.166***
	Cronbach's alpha	***0.837***
Vendor Support		
	Adequacy of technical support during ERP implementation	0.734
	Adequacy of technical support after ERP implementation	0.909
	Quality of technical support	0.764
	Adequacy of training provided	0.770
	Relationship with other parties in the ERP implementation project	0.853
	Variance explained (%)	***65.382***
	Cronbach's alpha	***0.856***
Consultant Competence		
	Provides evidence of the value of the methodology	0.923
	Provides a complete understanding of the new methodology	0.805
	Contributes expertise and experience in using the methodology	0.864
	Provides knowledge on how the new methodology will affect roles and responsibilities for personnel involved	0.870
	Variance explained (%)	***60.768***
	Cronbach's alpha	***0. 880***
Business Process Re-Engineering		
	Work processes are checked to prevent defects in products and/or errors in services	0.756
	Work process are improved or established to facilitate coordination of activities with external organization	0.888
	Variance explained (%)	***37.471***
	Cronbach's alpha	***0. 711***
ERP Project Team Member Competence		
	The team members have IS knowledge	0.637
	The team members have business knowledge	0.847
	The team members have communication skills	0.745
	Variance explained (%)	***55.949***
	Cronbach's alpha	***0. 571***
ERP Project Manager Leadership		
	S/he keep track of mistakes of subordinates	0.911
	Problems must become chronic before s/he takes action	0.801
	Variance explained (%)	52.506

	Cronbach's alpha	0. 487
Top Management Support		
	Top management actively engage in recruiting ERP implementation team personnel	0.903
	Top management often emphasize managing and controlling the tasks for ERP implementation and operation effectively	0.757
	Variance explained (%)	***38.693***
	Cronbach's alpha	***0. 666***
User Support		
	Users are not enthusiastic about the ERP project	0.864
	Users have a negative opinion about the ERP system	0.951
	Users not ready to accept the changes brought about by the ERP system	0.885
	Variance explained (%)	***81.186***
	Cronbach's alpha	***0. 876***

TABLE 2: Significant Factor Analysis and Reliability Analysis Results.

6. DATA ANALYSIS

It can be recalled that the first and the second questions and objectives of the study are to assess the level of ERP implementation success and of ERP internal and external critical success factors in Saudi Arabia respectively.

The appropriate analysis that could answer such objectives is averaging (means) through one-sample t test analysis. Since the scales for each of the constructs are on 5 point Likert scales, the test value of 3 was used and the result in Table 3 shows that the means for five variables that include ERP implementation success, vendor support, consultant competence, business process re-engineering and user support are significantly different from neutral value 3 since the significance values are less than 0.05 at 5% level of significance.
However, since the significant value of top management support is 0.086 which is more than 0.05 at 5% level of significance, thus the mean of this variable is not significantly different from neutral value 3.

One-Sample Test Test Value = 3				
	Means	**T**	**Df**	**Sig. (2-tailed)**
ERP Implementation Success	2.1993	-10.570	73	0.000
Vendor Support	3.5444	12.992	71	0.000
Consultant Competence	4.0069	11.777	71	0.000
Business Process Re-engineering	3.6042	7.358	71	0.000
Top Management Support	3.1875	1.742	71	0.086
User Support	2.0845	-8.612	70	0.000

TABLE 3: One-Sample Test.
Note: Mean scores are based on a five-point scale

The objective of the third research question is to examine the impact of critical success factors on the ERP implementation success. It is worth noting that it was based on this objective that the seven study hypotheses were developed. Since based on the result of reliability analysis, the

factor scales of the two dimensions of ERP critical factors were found not reliable, thus only the hypotheses of the remaining five dimensions were tested. And, correlation analysis was the appropriate statistical tool used in testing those hypotheses.

The results in Table 4 indicates that the influence of ERP implementation success appraisal on vendor support, consultant competence, business process re-engineering, top management support and user support are all significant at 5% level of significance. This is because all the significance values are less than 0.05.

Thus, since negative relationship was found with respect to vendor support and consultant competence, both hypotheses 1 and 2 were not supported. But, the remaining three tested hypotheses, that is, hypotheses 3, 6 and 7 were supported.

		Vendor Support	**Consultant Competence**	**Business Process Re-engineering**	**Top Management Support**	**User Support**
ERP Implementation Success		-0.308**	-0.254**	0.293**	0.314**	0.753**
	Sig. (2-tailed)	0.008	0.031	0.012	0.007	0.000
	N	72	72	72	72	71

TABLE 4: Pearson Correlation
**Correlation is significant at the 0.05 level (2-tailed).

The last research objective aims at examining whether ERP implementation success differs based on the demographics of the respondents' organizations. The ANOVA results in Table 5 report such relationships.

The results indicate that the variable is significant with respect to occupational level, organizational type and organizational experience. However, the variable is not significantly different with respect to organizational ownership and organizational size because the values of $p > 0.05$

ERP Implementation Success	F	P
Occupational Level	6.003	0.001
Organizational Type	4.724	0.012
Organizational Ownership	2.437	0.095
Organizational Size	0.924	0.402
Organizational experience	5.488	0.006

TABLE 5: ANOVA Summary Statistics
Notes: F-values are the result of a one-way ANOVA at $p < 0.05$ level of significance.

7. LIMITAION, IMPLICATION, AND RECOMMENDATION

In spite of the novelty of the study, it suffers from some limitations that are common to many other researches. One of such limitations is that majority of the respondent organizations are manufacturing companies and non-governmental organizations. These disparities have a tendency of skewing the responses.

Similarly, the study sample size is an issue and this limitation may limit generalizations of the findings across the whole kingdom. To mitigate these limitations, future researches could replicate this study by obtaining responses of almost equal size between the private and the public sector. The sample size should also be increased across the whole Kingdom so as to ensure that the findings are generalized.

Furthermore, further studies could expand the present research by exploring other factors that have potential to influence ERP implementation success in the Kingdom of Saudi Arabia.

8. CONCLUSION

The results of this study not only added to literature but also of practical implications to industries in the Kingdom of Saudi Arabia. With respect to the first construct, ERP implementation success, the result indicates that the mean (average) of this construct is significant and below the test value (3). This implies that ERP implementation projects are not successful in the Kingdom of Saudi Arabia. This finding though not conducive to the ERP adopting organizations in the Saudi Arabia, it is however in line with the practical outcome of many ERP implementations projects [4]. This finding lends support to that of [54] that as much as 90% of ERP implementations turn into runaway projects. Therefore, for those organizations that implemented ERP, it can be inferred that the investment which is usually enormous is not paying off. And, for those organizations that are considering the implementation, the finding could serve as a basis for their decisions that ERP projects in Saudi Arabia need careful considerations for it to be successful.

Moreover, the averages (means) of the five dimensions of ERP critical success factors are significant with respect to all except top management support. This indicates that organizations in the Saudi Arabia do not perceive support from the top management as vital factor that guarantees success of ERP implementation. However, vendor support, consultant competence, business process re-engineering and user support are considered important elements that foster ERP implementation success. Thus, this is a pointer for those organizations that have implemented ERP and those that are considering its implementation to ensure that these four confirmed success factors are integral part of their ERP implementation project.

Interestingly, as hypothesized, the correlation analysis results demonstrate significant effect of the entire five ERP critical success factors on the ERP implementation success. Thus, these findings bolster that of past studies [15, 16, 20, 45, 55].

Apart from adding to the literature, the correlation result also is of practical relevance. It indicates that ERP implementation that is accompanied with vendor support, consultant competence, business process re-engineering and user support will ensure successful implementation. Since based on the perceptions of the respondents their ERP implementations are not successful, there is hence a need for the ERP adopting organizations to incorporate these CSFs in their ERP implementation projects as well their other best practices that could ensure successful implementation of the projects.

The finding that no significant difference exist between organizational ownership and organizational size with ERP implementation success shows that the success of ERP implementation in Saudi organization does not depend on whether an organization is privately or government owned . Thus, ERP vendors will find this finding pleasing as it indicates that their solutions are successful in different kind of organizations in the Saudi Arabia. However, the ANOVA result shows that the ERP implementation success differs among organizations based on organizational type and organizational experience. Thus, the rate of ERP success is not equal between manufacturing and service industries and between well established firms and others. Hence, management and ERP vendors alike need to consider this phenomenon when adopting ERP solutions.

Finally, it can be concluded that ERP implementation success in Saudi Arabia is influenced by vendor support, consultant competence, business process re-engineering, top management support and user support. Similarly, it can be said that, based on the views of the study respondents, ERP implementation projects in the Saudi Arabia are relatively unsuccessful.

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Java Implementation based Heterogeneous Video Sequence Automated Surveillance Monitoring

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Abstract

Automated video based surveillance monitoring is an essential and computationally challenging task to resolve issues in the secure access localities. This paper deals with some of the issues which are encountered in the integration surveillance monitoring in the real-life circumstances. We have employed video frames which are extorted from heterogeneous video formats. Each video frame is chosen to identify the anomalous events which are occurred in the sequence of time-driven process. Background subtraction is essentially required based on the optimal threshold and reference frame. Rest of the frames are ablated from reference image, hence all the foreground images paradigms are obtained. The co-ordinate existing in the deducted images is found by scanning the images horizontally until the occurrence of first black pixel. Obtained co-ordinate is twinned with existing co-ordinates in the primary images. The twinned co-ordinate in the primary image is considered as an active-region-of-interest. At the end, the starred images are converted to temporal video that scrutinizes the moving silhouettes of human behaviors in a static background. The proposed model is implemented in Java. Results and performance analysis are carried out in the real-life environments.

Keywords: Anomalous Events Detection, Background Subtraction, Frame Extraction, Foreground Detection, Surveillance.

1. INTRODUCTION

Video surveillance is actively employed to monitor locations and the behavior of people in private and public areas. Since events resembling the terrorist attacks in all over the world, there have been a further deploying the need for video surveillance systems to assure the safety of people in diverse locality. These kinds of system can be utilized in case of monitoring crucial events such as crisis or disasters. For that, several cameras, technologist and supervisors are required to supervise the video streams for many hours. In order to provide the solution for this problem, an artificial intelligent system based surveillance system was proposed. Such an automated system can observe events to realize a perspective susceptible analysis of the diverse circumstances.

Automatic Video Surveillance (AVS) is a computationally challenging process due to its sequence of tasks to accomplish the identification of diverse foreground objects. Surveillance is commonly employed for describing observation of human behaviors based on recorded video sequence. In narration of video surveillances, plenty of works had been completed [1][2][3][6], however, detecting human behavior is still an open problem in order to take on diverse circumstances and timely actions.

Analysis of Human behavior (AHB) has various steps such as background subtraction, foreground detection, tracking meticulous behavior and analyzing behavior of a subject [1]. This approach has various applications such as lick recognition; video surveillance in public or private locality, behavior based multimedia retrieval, security access and prohibition of unauthorized people and many others. Furthermore, algorithms of intelligent video surveillances can involve complex computation and relatively powerful technology that acts like a human intelligence agent. However, keeping track of multiple people, vehicles, and their interactions, within a multifaceted urban environment are a difficult task. The user obviously should not be looking at two dozen screens showing raw video output in order to interpret the selective events. Our approach is to provide an interactive, graphical user interface and tracking the human.

In this paper, we propose a methodology to integrate heterogeneous environment for video surveillance monitoring system to detect the behavior of human using Java real-time classes. This method assists optical flow computation method in order to localize subjects or objects in real-life scenario. A Java based platform independent tool is proposed to detect the background, localize the objects and locate the anomalous events such as walking with diverse action.

The remainder of this paper is organized as follows: Section 2 describes the literature review of the proposed problem. Proposed Java based automated video sequence methodology is depicted in Section 3. In Section 4, the Java implementation and result analysis of the proposed system is illustrated. The concluding remarks and future enhancement are revealed in Section 5.

2. LITERATURE APPRAISAL

In the literature appraisal of automated surveillance, certain, notable researches were done based on pattern recognition and Computer vision algorithms. However, integration of surveillance system in the real-life scenario and platform independent is highly inadequate. In the Literature review [4], human movement analysis is an important task in the Computer vision perspective. It includes background subtraction, detection, tracking, and recognition of subjects in the real-life scenarios. Human movement analysis can be categorized into four categories [8], such as low level vision detection, intermediate level vision tracking, high level vision behavioral analysis and extreme level vision anomalous event analysis. Subject detection is a process of detecting subject from a video sequence by applying background subtraction, foreground extraction and locates active-region-of-interests. In the extreme level vision, a watch dog algorithm will be invoked to integrate and monitor several related video clips to localize and track the anomalous events, respectively.

A system was proposed by Collins et al. [1] to monitor multiple cooperative video sensors to provide continuous coverage of people and vehicles in a cluttered environment. In that, Video Surveillance and Monitoring (VSAM) detected the objects' or subjects' movements in a complex environment and also described to find the detection objects' categories such as truck or car or human or living thing. This is based on color analysis. Propositionally, time complexity is increased based on number of the subjects or objects which are available to classify in the color space.

There are three conventional approaches [2] to detect objects such as temporal differencing, Gaussian mixture model and Optical flow. Temporal differencing is a process of adaptive to dynamic environments, but generally does a poor job of extracting all relevant feature pixels. Gaussian mixture model provides the most complete feature data, but is extremely sensitive to dynamic scene changes due to lighting and extraneous events. Optical flow can be used to detect independently moving objects in the presence of camera motion. However, most optical flow computation methods are computationally complex, and cannot be applied to full-frame video streams in real-time without specialized hardware and software integration [3] [5] [10][11]. In [9], an approach of detecting objects in dynamic background was described for noisy environment.

One additional benefit of using our proposed approach is its lower cost. Other surveillance systems do not eliminate human participation in solving investigation task fully. The proposed approach significantly simplifies the job and assists an analyst or investigator, who is not a professional in statistics and programming to manage the process of extracting knowledge from a video scene [4][6][7][12] in heterogeneous environment.

Based on the state-of-art review in the automated surveillance monitoring, in this paper, we contributed Java implementation based heterogeneous video monitoring to assist optical flow computation method to localize subjects or objects in real-life scenario without any specially designed hardware.

3. PROPOSED METHOD

In this section, the proposed method for Java implementation based heterogeneous video monitoring is presented. It has a sequence of operations that are required for the automated silhouettes behavior observation.

3.1 Classes Association and Preprocessing

The proposed approach is associated with object oriented design (OOD) in Java Media Frame work. Association relationship of classes' attributes, methods and exceptions are illustrated in Figure 1. It also reveals the association of classes' hierarchy of the proposed approach in a Unified Markup Language (UML) static structure.

Audio Video interleaved (AVI) format is invoked and its essential tracks are interpreted for observing progression of events in a scenario. An exception is thrown if any problem exists while loading. In this process, Java Media Framework media player is used to open and to load and run the AVI in a player. Similarly, the panel is loaded to select the video file by using Java swing and media framework. Here, a program is designed to load a panel. This panel is invoked to load AVI. Another panel is utilized for extracting frames. It is called the loading panel program. The following is an algorithm to load AVI in the heterogeneous environment.

Step 1: Choose surveillance file over internet or intranet.

Step 2: For media, Universal Resource Locator (URL) is initialized as null for initial processing.

Step 3: Try for locating the file over internet. If it exists, then media tester is loaded; otherwise malformed URL exception is invoked and control goes to Step 6.

Step 4: If mediaURL is not Null, then video sequence is showed on the heterogeneous environment and control goes to Step 5 else Null content is expected in the stream of loaded sequence and execution goes to Step 6.

Step 5: For Manual interaction, User Navigation properties are loaded.

Step 6: End the Loaded process and control goes to Frame Extraction.

Once video sequence is loaded, then end-users can give their options of human behavior or extreme level vision for anomaly events.

Frame extraction is a process to extort sequence of frames from the loaded video sequence over the internet or intranet. Java Media Frame package creates the Processor class for extracting frame from the sequence. After creating and configuring, the processor control obtains the track control for video track. Codec class is utilized to instantiate JMF package to extract the set of frames to access codec from the data flow path. Then, Set the track control to flow of the path and then extract the progression of frames. The following algorithm describes frame extraction process.

Step 1: Processor initialization.

Step 2: Let State Transition is true.

Step 3: Try to create a processor from the process Manager.

Step 4: If process exception causes due to unable to create process, then return false and control invoked exit else add controllers to the processor.

Step 5: Put the Processor into configured state. If Processor is configured successfully then control goes to Step 6 for obtaining track control in the temporal data; otherwise Processor configuration is failed and control is treated as false alarm.

Step 6: If track_control is null, then there is no track control exists for the processor and control invoked exit else track control is found and proceed with Step 7.

Step 7: Seeking the track control for the video track as in (1).

$$\phi_{i+1} = \prod \phi_i + \alpha\lambda \tag{1}$$

where ϕ_i denotes object tracking control based on i[th] frame in the sequence and ϕ_{i+1} represents object track control based on (i+1)[th] frame in the sequence. The track control will be monitored as described in (2).

$$\omega = \begin{cases} True & if \phi_i \in V \\ False & if \phi_i \notin V \end{cases} \tag{2}$$

Step 8: If video_Track is null after seeking entire temporal data, then the input temporal media doesn't have any video_track and control goes to Step 15.

Step 9: Instantiate and set the frame access codec to the data flow path and realize the processor.

Step 10: parseVideoSize (video Format) is initialized for parsing the size of the video from the string of video format.

Step 11: Wait for state Synchronization and perform a Java coding to make synchronization of state transition. Next, event synchronization is performed to link the events in a given temporal data. Step 12 is carried out to do the event synchronization based on the controller keep posted.

Step 12: Process Controller update is performed to incorporate entire synchronized events. A Java coding is invoked to carry out controller update.

Step 13: The process of converting temporal sequence to static frame by means of converting AVI-to-JPEG (Joint Photography Expert Group). The Java source code is employed to implement an interface called preAccessCodec from the Codec (Step 9).

Step 14: Store the static frame into JPEG format. The accessFrame is invoked to convert each frames of temporal data into RGB JPEG file for further processing.

Step 15: Stop the process of Frame extraction and Gray scale Conversion model is invoked.

Gray scale pixels are more convenient for processing intensity variation of signals due to widely varied shine and out-door scenarios. In this, the images are composed exclusively of shades of

gray varying from black at the weakest intensity to white at the strongest. Each pixel from the original image is extracted. Each pixel with RGB value is separated and Gray pixel value is computed. The Gconvert Java class is the source code to convert the three-dimensional color space value into one-dimensional gray space. After the gray conversion, each frame of the temporal background pixels is subtracted, which is based on the reference frame, in order to localize the foreground silhouettes.

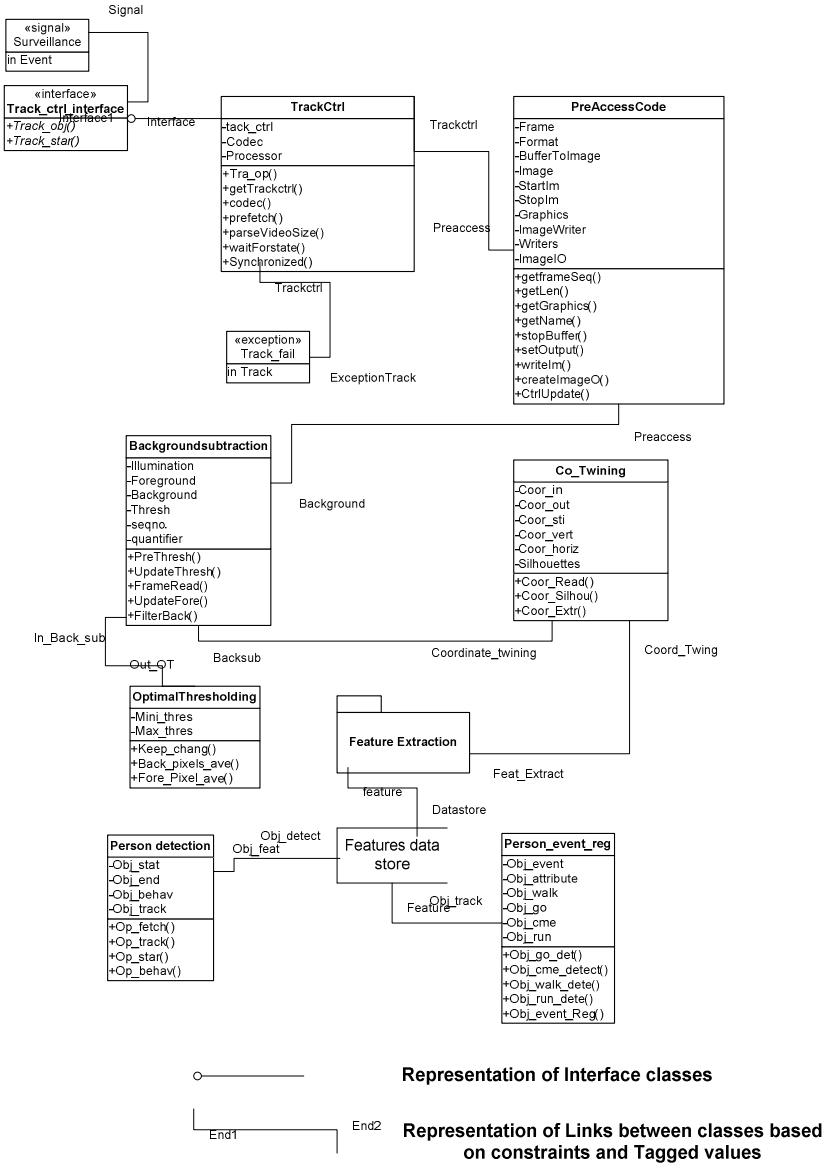

FIGURE 1: Class hierarchy using UML static structure for proposed video surveillance method.

3.2 Background Subtraction

In the background subtraction, initial frame has been treated as reference frame and do the deducting process on rest of the frames from the referred frame. A group of volume-of-pixels (voxels) of reference image is involved for the subtraction process with indexed image that is currently being considered for the background subtraction. By using the calculated threshold value, the newly obtained images with black and white pixels are stored for further pre-

processing. The obtained result of the background subtraction is a possible of silhouettes which are obtainable from a scene. The background deduction process is performed using (3),

$$P(R_i) - P(B_i) = 0,$$
$$abs[(P(R_i) - (P(B_i) + P(F_i))] = P(F_i), \quad (3)$$

The $P(R_i)$ represents probability of the pixels which are in Reference frame R_i, $P(B_i)$ denotes probability of the pixel value in the current frame which is to be involved for background subtraction, and $P(F_i)$ is probability of absolute values which are obtained after the background subtraction.

3.3 Coordinates Twinning

In this module, silhouettes are taken as an input to scan the coordinates in order to obtain the twining process for localizing the Active-Region-of-Interest (AROI). This is the primary process of identifying the stimulus of diverse activities which are opted for the surveillances. In our algorithm, twining process starts from horizontal coordinate positions. Entire silhouettes are scanned until the black pixel occurs in a first row of scanning. If set of 'ON' pixel is encountered, then set of current positions is marked and then scan is continued. If set of volume-of-pixels is congregated, then the specified threshold is bounded. Next, scanning continue in vertical direction to mark the set of 'ON' pixels. The whole outline of the possible contour is treated as silhouettes. However, from the obtained silhouettes, we could not directly reveal that the contour belongs to stimulus of event. Once register the possible silhouettes then matching process is required for identifying the diverse activities of subjects from the given temporal sequence.

3.4 Optimal Threshold Estimation

The algorithm of the optimal threshold [7] is employed to estimate the threshold values. There is no knowledge about the exact location of objects in the extracted frame. Hence, consider as an approximation that the four corner of the image contains background pixels and remaining contains objects. Compute μ_B and μ_F as the mean background and foreground of the gray space, respectively. The thresholds are computed as given in (4),

$$\mu_B = \frac{1}{PQ}\sum_{i=1}^{P}\sum_{j=1}^{Q} B(i,j), \mu_F = \frac{1}{NM}\sum_{i=1}^{N}\sum_{j=1}^{M} F(i,j), \quad (4)$$

where P and Q are the number of background pixels, N and M are the number of foreground pixels, $B(i,j)$ and $F(i,j)$ are background and foreground information of the image, respectively. If background and foreground are equal in the distribution of pixels, then optimal threshold is the average of the means as described in (5) otherwise (6) has been computed in order to compensate the background and foreground pixel spaces.

$$\lambda_T^{t+1} = \frac{|\mu_B + \mu_F|}{2}, \quad (5)$$

$$\lambda_T^{t+1} = N_d(\mu_B, \sigma_B) + N_d(\mu_F, \sigma_F), \quad (6)$$

where λ_T^{t+1} is a threshold value at t+1 time, N_d denotes normal distributions of mean and standard deviation of pixels.

3.5 Feature Extraction and Object Tracking

In order to detect person, Haar features have been utilized. These Haar features are having low and high frequency components of multi-resolution signals. Based on the person features, connected component analysis have been involved to detect the coordinate of the subjects which are appearing in the scene. While training the manually extracted person silhouettes are implicated as optimistic exemplars, in that, a region of single person appearing in the template of surrounding substance. Furthermore, pessimistic exemplars such as no person on the scene are also trained. They are extracted randomly from the frame of image sequences based on empirical testing with no foreground occurrences. The followings are the sequence of steps of training process.

Step 1: Optimistic exemplars are trained with diverse backgrounds.

Step 2: Pessimistic exemplars are trained in order to determine the negative cases.

Step 3: Both Optimistic and Pessimistic exemplars are involved for learning process with diverse foreground for adopting dress variations from person-to-person.

Step 4: Initial approximation for both exemplars are obtained and they are classified manually.

Step 5: The system is retrained using diverse exemplars in order to adapt to different characteristics of scene.

Step 6: In order to make recalling process, a hetroassociator has been formed.

4. IMPLEMENTATION AND RESULTS ANALYSIS

Implementation has been done in Java in order to monitor the temporal space with static background video sequence. The following sections are described to illustrate result analysis of the proposed method.

4.1 Loading Input and Frame Extraction

This phase aims to focus on implementing heterogeneous video sequence to monitor the moving object using platform independent Java class. Figure 2 shows the media tester which is utilized to load AVI. Once the specified format is loaded into a default media player, then, the frame extracted module is invoked to extract the frames from the chosen video file and store the extracted frames in a knowledge base of silhouettes. The typical extracted frames are illustrated in Figure 3. It consists of a sequence of 145 frames for a real-life walking surveillance with data rate of 4500kbps, total bit rate was 4564kbps and frame rate was 30 frames / second.

FIGURE 2: Depiction of input Video File has length of five seconds, frame width and height is 320 and 240, respectively.

FIGURE 3: Representation of typical Extracted Frames from the given video.

4.2 Gray Scale Conversion

The extracted frames are involved to be read sequentially and then regenerated into gray image. From each extracted frames, pixel by pixel scanning is carried out for collecting RGB value of

each pixel. This is done by using getRGB() method and r,g,b value of each pixels is multiplied with some specified predefined luster values in order to obtain a rearranged r, g, and b values for all pixels. Sum of the multiplied RGB value is assigned to each pixel by using setRGB() method to attain gray images. The result is shown in Figure 4.

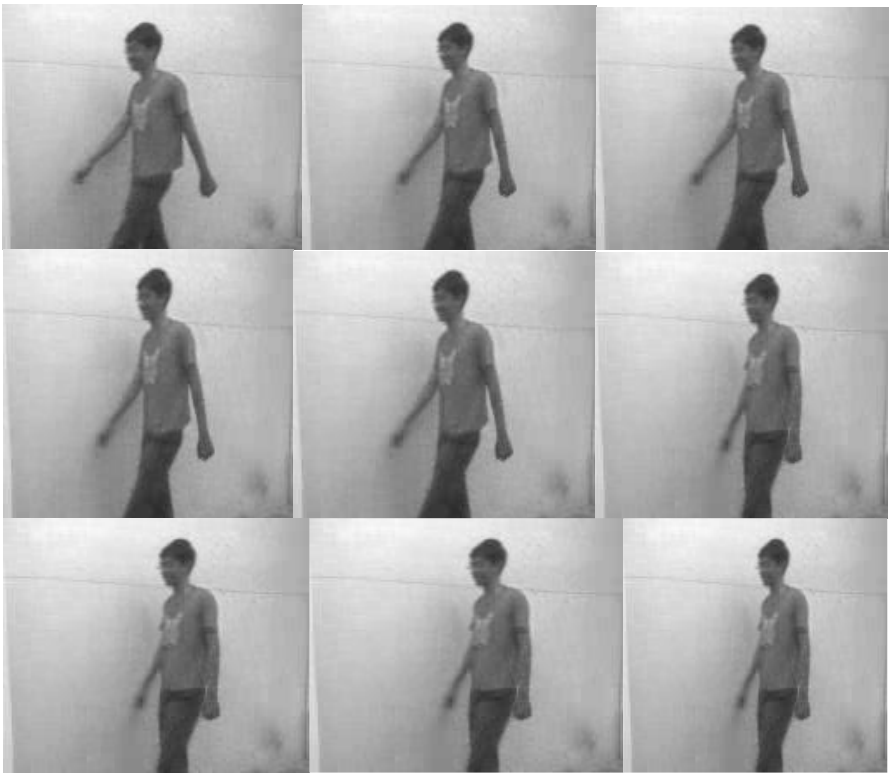

FIGURE 4: Sequence of Gray images convolved from the extracted frames.

4.3 Deduction Process

After gray conversion, the principal image is noted as a reference frame. This is shown in Figure 5. The remaining frames are deducted from reference frame (typically Figure 6) to obtain foreground images as shown in Figure 7.

Before Deduction

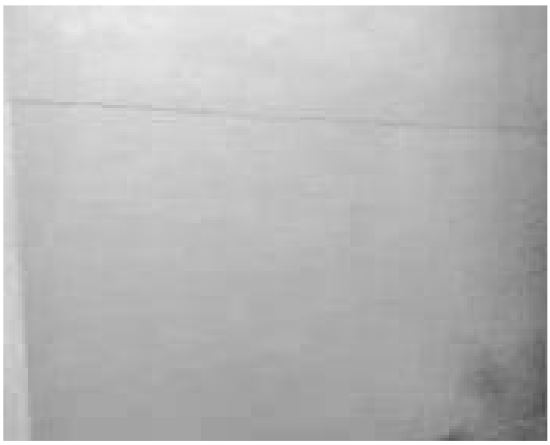

FIGURE 5: Reference image.

FIGURE 6: Foreground image.

After Deduction

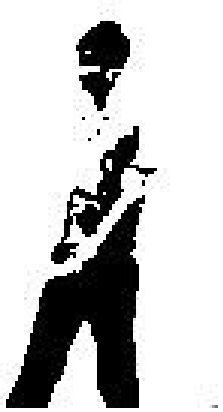

FIGURE 7: Deducted silhouette image that shows the walking chic.

The important process carried out here is that all the pixels are converted into binarization based on the predefined threshold. In this process, the first background image is considered as reference frame and rest of the frames are deducted from the reference frame. The crucial factor is how to estimate optimal threshold values for diversity of temporal sequences. The predefined threshold values are estimated using optimal threshold estimation method which includes luster and other artifacts. Since the result of all the three r,g,b picture elements are identical, red color elements is chosen for the deduction process. The value of each pixel in the reference image and the value of each pixel in the rest of the images are deducted one by one. If the deducted pixel value is less than the threshold value, then set the new image pixel as black or white and hoard those images. If the deducted pixel value is greater than threshold value, discard the obtaining images. Figure 8 depicts the frames with foreground object obtained using the proposed approach.

FIGURE 8: Deducted Images of extracted frames.

Once frames are deducted, histogram equalization was employed for enhancing the contour of the silhouettes in order to make the registration for silhouettes matching. The collection of silhouettes border is enriched and binary feature sets are indexed to store contour blob along with optimal thresholds of each temporal sequences. Figure 9 and Figure 10 show some possible silhouette of human body and walking chic, respectively.

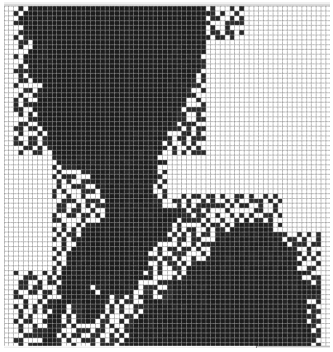

FIGURE 9: Representation of Silhouette of head portion and border of cloth.

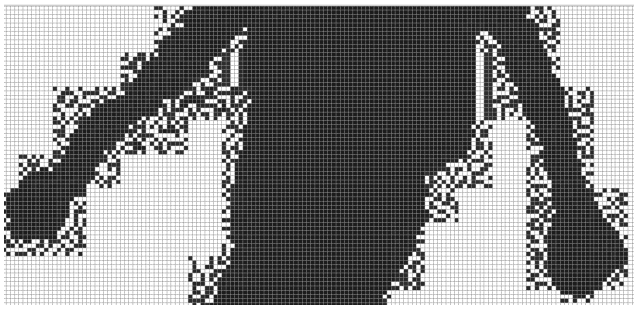

FIGURE 10: Illustration forward walking silhouettes.

4.4 Finding and Toning Coordinates

The deducted images have been used for the further process known as co-ordinates matching. In this process, at the most primitive x, y positions are fixed and scan the images horizontally until the set of black pixel is encountered. After finding the contour of black pixel, the encountered position value is perceived in x and y as the co-ordinate of original images equal by validating with ablated images. The acquired coordinate positions in the deducted image are matched with the original image. Silhouettes are stared. They are referred as Active-Region-of-Interest (AROI). This operation is employed using graphics class in Java as shown in Figure 11.

4.5 Performance Analysis

Intensity variations of silhouettes were observed with respect to dark blobs oscillation either in clock or anti-clockwise directions. Figure 12 illustrates intensity variations of black boundaries of

silhouettes. It reveals that number of picture elements of silhouettes in AROI ranges from 0 to 450 pixels and peak intensities from 0 to 5 have more accounts of observations. Implicitly, it discloses that proposed approach of extraction of silhouettes in heterogeneous platform gives prominent improvement.

In next phase of experiment, rest of the intensities was observed. This is shown in Figure 13. It reveals that white region of the silhouettes ranges from 0 to 255 and number of picture elements in peak white region were conspicuously which is more suitable to matching the objects.

FIGURE 11: Illustration of Detection foreground images.

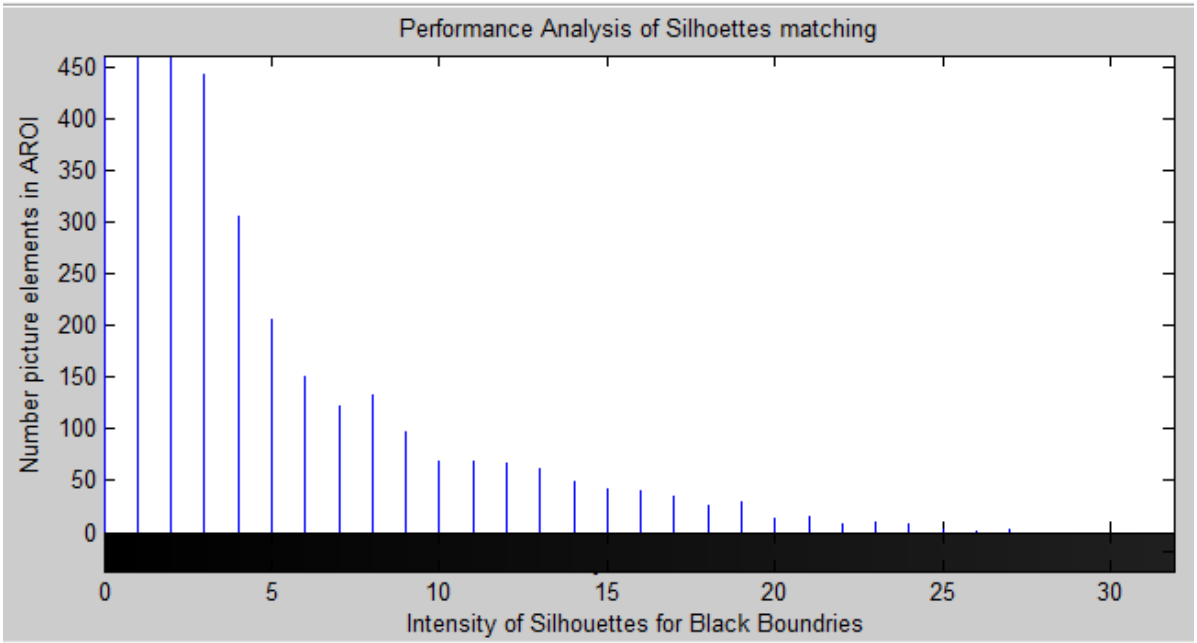

FIGURE 12: Intensity variations of black boundaries of silhouettes.

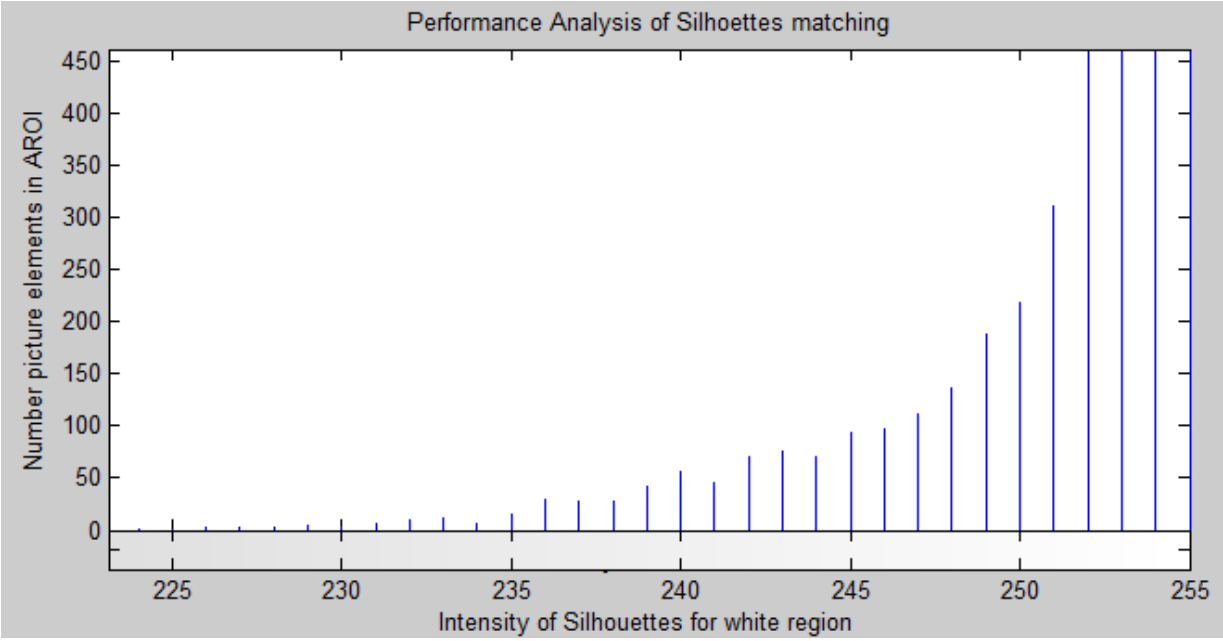

FIGURE 13: Intensity variations of white region of silhouettes.

The Mean Square Error (MSE) and the Peak-Signal-to-Noise Ratio (PSNR) are the two error metrics utilized to compare image quality. In our experiment, PSNR computes the ratio of decibels of noise in extracted silhouettes after invoking in a heterogeneous environment. It normally computes highest peak of the input signal of the extracted frame and noise embedded due to external sources in the resultant frame. This ratio is often used to evaluate the quality measurement of the performance of algorithm between a referenced frame and an output frame of sequence of images. The higher ratio of the PSNR is the better quality of the silhouettes. This is shown in Figure 14. It reveals that resultant frames in the initial states of silhouettes were

approximately 27.8dB of PSNR and drops to approximately 19.8dB of focal point of silhouettes. This reveals that proposed algorithm produces better quality silhouettes within first four frames of computation.

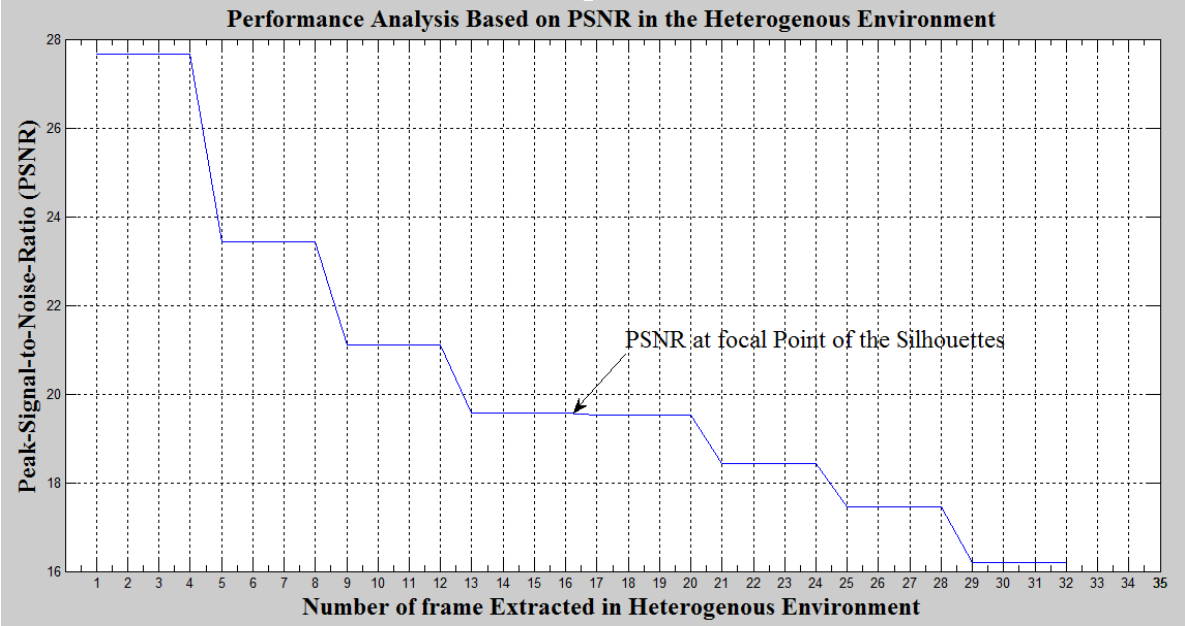

FIGURE 14: PSNR of silhouettes after extracting from the heterogeneous environment.

The MSE represents the cumulative squared error between the referenced and resultant frame, whereas PSNR represents a measure of the peak error. The lower the value of MSE is the lower the error of the silhouettes extraction algorithm. Figure 15 reveals that the first four frames have approximately 150 MSE on initially extracted silhouettes.

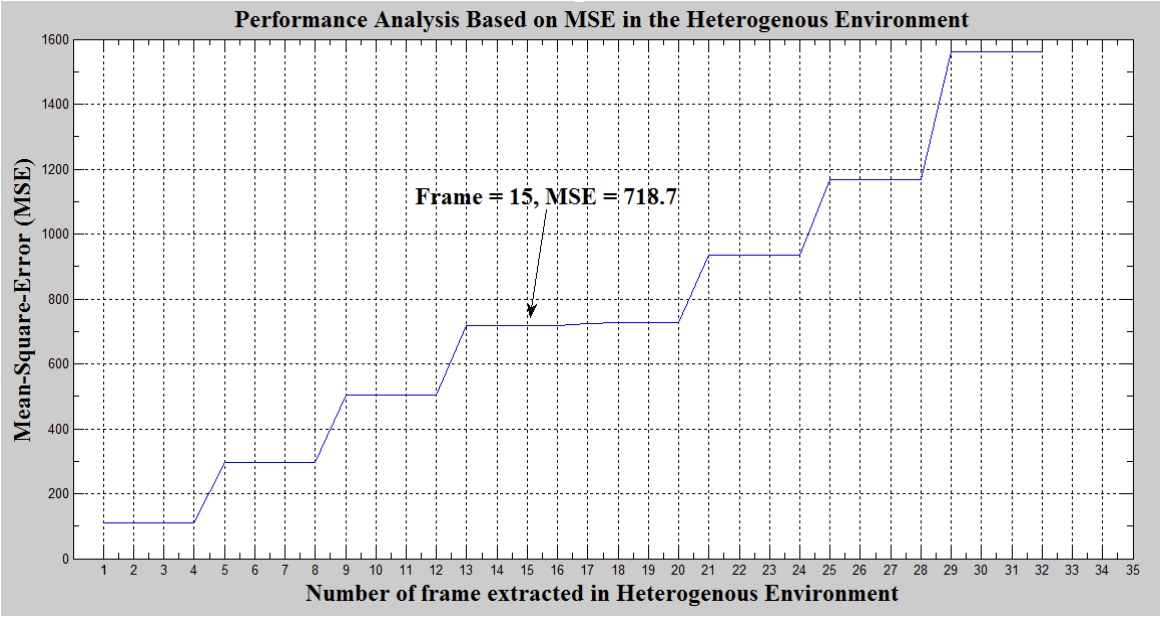

FIGURE 15: MSE of silhouettes after extracting from the heterogeneous environment.

This model reveals that the proposed heterogeneous environment algorithm will easily be deployed with existing traditional automated surveillance system in order to improve the performance over the internet oriented automated surveillance system. In addition, our proposed algorithm will incorporate in platform independent networks.

4.6 Comparative Study for F-Measure Computation

The proposed approach error rate computation was compared with wavelet based object starred approach. For that F-Measure error rate computation was taken. In this measure, the erroneous association of lost true positive pixels and the erroneous association of superfluous positive pixel were computed. In order to evaluate the correctness of both the foreground and background detection together, the overall performance of the object starred algorithms was compared with already existing method of object detection in moving frames. For this comparative study, 14 diverse video segments were chosen namely from A to N with different background and foreground objects. F-Measure was computed based on the error in pixel differences. The average error rate of proposed and existing method of F-Measure was observed and their respective errors were depicted in Figure 16. In Figure 16, X-label is depicted A to N video segments and Y-label has a various ranges of F-measures. It is observed that the proposed Haar starred algorithm detects the foreground objects which are chosen for tacking with less F-measure error rate. This is due to enhancement of the proposed approach in object detection for heterogeneous video formats adaptations in diverse circumstances and scenarios. The proposed approach achieved a minimum of 1.01 and maximum of 2.97 F-measure error rates whereas existing wavelet based starred approach minimum and maximum F-measure were 2.77 and 5.47, respectively. It is found that the proposed approach outperforms the existing wavelet based starred approach in terms of F-measure error rates. Furthermore, it is observed that existing wavelet approach could fail in heterogeneous video platform in terms of starred foreground objects.

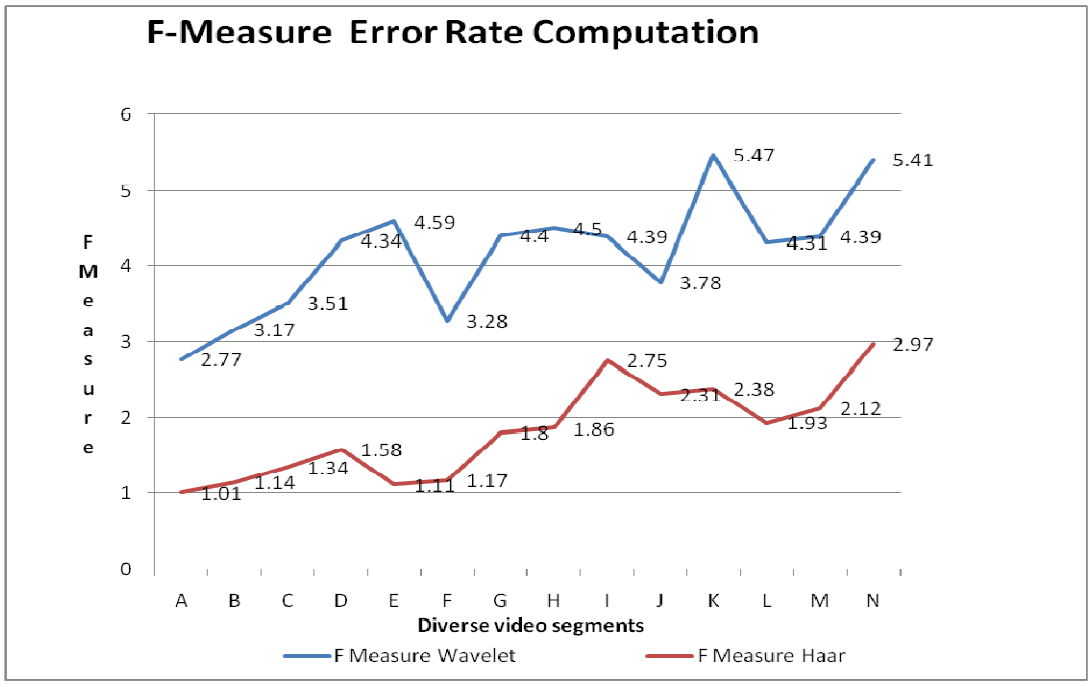

FIGURE 16: Comparative study of proposed approach of F measures, Haar with wavelet starred algorithms.

5. CONCLUSION AND FUTURE ENHANCEMENT

In this paper, we present a Java implementation based heterogeneous video surveillance monitoring in a static background. This is a generic smart video surveillance model in the platform independent environment. JMF is used to extract images from the video file and those images are

then used for pre-processing. Binary silhouettes images are extracted and registered for matching process. Based on binary features, video is highlighted the moving object. Java Graphics classes are used for making starred on active region. The starred images are converted to video which observes the human movement.

In further research, a method will be suggested for synthesizing multiple threats and anomalous stimuli from several cameras to hypothesis the human characteristics from the pops up of silhouettes.

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