

**An Information System for Equipment Management and  
Consumable Inventory Control for ACTOM (Pty) Ltd.**

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## Executive Summary

The final year project is currently underway at ACTOM offices at Komati Power Station which is located between Witbank and Middelburg. An analysis of the problems within the equipment department at the offices was conducted. The system that currently used for control and security of equipment on the power station site was found to be insufficient, and many of the vital processes are virtually non-existent.

The aim of the project was to identify and solve problems related to ACTOM's equipment store at Komati power station. It was found that the processes that the equipment store follows is not up to standard and will require analysis. The manager and employees of the equipment store have had numerous problems regarding the current system that they are using.

The discussions within this document are related to item identification; it interprets the different methods of equipment identification. These methods include barcode identification, radio frequency identification and manual numbering of equipment. Manual numbering of equipment is currently used by the equipment store.

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## 1. Introduction

ACTOM (Pty) Ltd is the largest manufacturing and distributing company of electrical equipment in South Africa. They currently employ 6000 people with an annual order intake in excess of five billion rand. The company consists of 33 operating units, 27 production facilities and 28 distribution centres throughout South Africa.

ACTOM (Pty) Ltd is a subcontractor to Eskom. The company is responsible for the maintenance and repair of the power stations boilers within each of the nine units. This line of work requires systems that are able to handle the constant problems that the company is faced with, one of such being the control of equipment on the Komati site. There have been numerous occasions when the site has been flagged by the financial department as to lost equipment. ACTOM is a repair and maintenance company and thus the company's equipment is its main asset.

The loss of equipment is one of the main problems ACTOM is faced with; this is due to the lack of security. The current equipment booking system is described as follows, a new employee arrives at the equipment department, a "toolcard<sup>1</sup>" is created for the employee, equipment that the employee requires is listed on the "toolcard", the "toolcard" is then sent to the finance office where the information is entered in to a Microsoft Excel document, the "toolcard" is then returned to the equipment department where it is filed. When the same employee returns and wishes to book out more equipment, the same "toolcard" must be found and the process starts again. If an employee's "toolcard" is full of entries, another "toolcard" is issued to the same employee. If the employee wants to return equipment, the same "toolcard" has to be found and it is marked off the list, the "toolcard" is then sent to the finance department again to register that the equipment has been returned. ACTOM bills ESKOM for the equipment that is being used, the billing is per day. The data that is captured at the finance department is purely for billing purposes. This means if an employee books out certain equipment for five days, the finance department will bill ESKOM for five days of use of the particular equipment.

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<sup>1</sup> Toolcard – This is a form that has a list of all equipment that the specific employee is currently using.

## **2. Background**

### **2.1. ACTOM Equipment management Background (As-Is):**

ACTOM currently conducts repair and maintenance on a number of ESKOM power stations, these include, Komati, Matimba, Tutuka power station. At each of these power stations, ACTOM has offices and equipment stores.

Currently there are 5 people working within the equipment stores, this excludes the people that pack, clean and transport the equipment. The responsibilities of the 5 people are as follows:

- Handling receiving/ sending of equipment to other sites, or to repair shops and the scrapping of equipment (clerk)
- Handling of purchase requisitions and contracts for equipment (clerk)
- Distributing equipment to workers (Store attendant)
- Aiding in distribution to workers (Store attendant helper)
- Managing of the equipment store and all the people (manager)

On a day shift all the people are on duty and during a night shift only the store attendant and his helper are on duty. Night shifts are not permanent, as it is not always required for employees to work night shifts.

The equipment store stocks a wide range of equipment from water hoses to welding machines. There are two types of equipment consumable and non-consumable, non-consumable would be for example a welding machine and consumable will be the welding rods used by the welding machine. This equipment is very expensive and is the most important asset to ACTOM.

### **2.2.The process (As-Is)**

Once an employee has been employed, he/she is sent to the equipment store to receive the required equipment that is required for the job. Most of the time, the equipment stores staff are unaware of new employees that have been appointed.

When the employee arrives at the equipment store a new tool card is created for the employee. This tool card contains a list of the equipment that the employee has booked out on his/her name. Each piece of equipment has a unique serial number. This serial number, the type of tool and the date is recorded on the employee's tool card. The employee then signs the tool card next to each of the entries; they are then allowed to take the equipment. The tool cards are stored in a tool card file, an employee can have more than one tool card as the entries can be full so a new tool card will be required.

If an employee returns from site and wishes to return equipment, the relevant tool card needs to be found, this is done with the employees clock number. The tool is signed off the tool card, highlighted, and stored to be sent to the finance department. The process is the same if a employee from site wishes to book out more equipment.

The tool cards that have been for the day is set aside, these are sent to the finance department, where the data is entered into a spread sheet. This data is captured for the purpose of billing, as equipment is billed per day, it is important to know when what equipment is being used. Refer to figure 3 for a screen shot of the equipment billing spread sheet. The tool cards are returned to the equipment department the following day. None of this data is captured by the equipment store.

When equipment is transferred to other sites or is received from other sites, one of the clerks are required to fill in documentation that says what is being transferred, the serial numbers and where it is being transferred to. This documentation is sent with the equipment to the destination. Copies of the transfer documentation are stored in a transfers file, not electronically.

Repairs are also documented, with details of equipment serial numbers, type of equipment and why it is being sent for repairs. There is also a repairs file where the repair documents are stored.

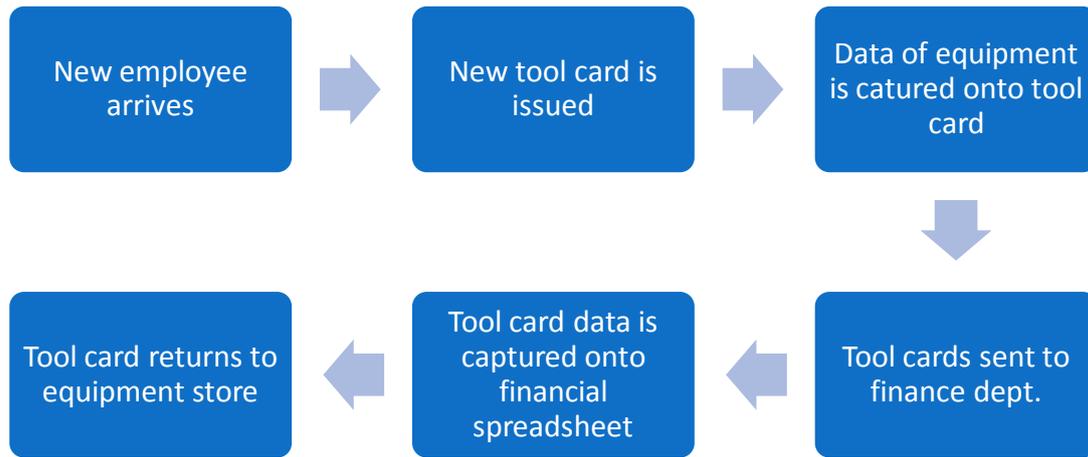


Figure 1: Process with new employee

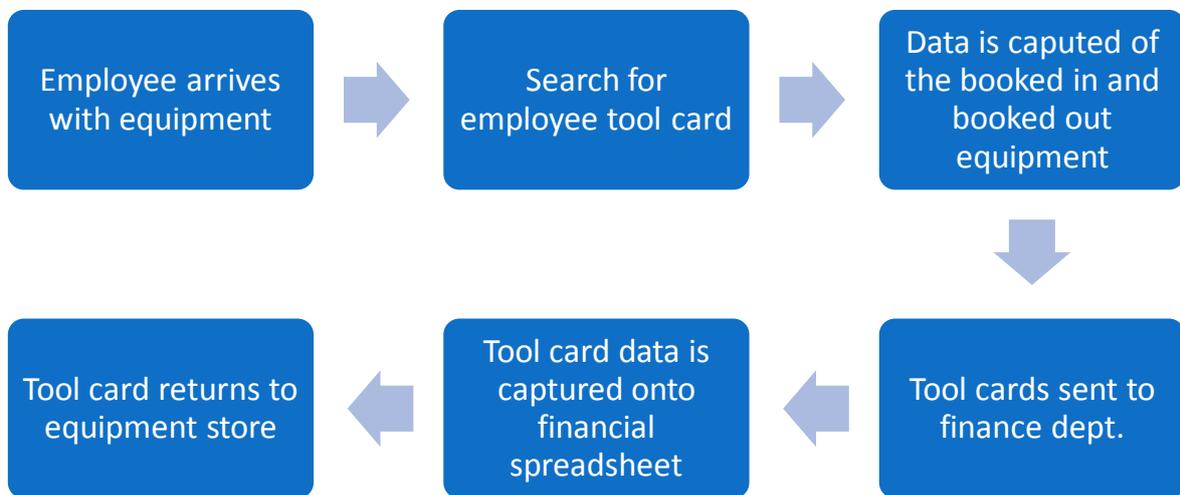


Figure 2: Process with old employee

EQUIPMENT SHEET															
FROM:															
TO:		12-Sep-11													
		HIDE			HIDE					HIRED EQUIPMENT		R -		#N/A	
										ALSTOM		R -		#N/A	
										R -		#N/A			
SERIAL NUMBER	DESCRIPTION	ISSUE DATE	RETURN DATE	PROGRESSIVE DATE	RETURN NUMBER	PROGRESSIVE PURATION	TOTAL PURATION	DAILY RATE	PROGRESSIVE VALUE	PROG TOTAL	CONTRACT #	FORMULA	FORMULA 1	FORMULA 2	FORMULA 3
AER 88	EXTENSION - 220V	08-Dec-09	10-Dec-09	10-Dec-09		3.00	3	R	R	R	KS0023 - 02	####		0.00	R -
AFBH 1343	SAFETY HARNESS - FULL BODY	09-Dec-09	09-Dec-09	09-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
AFBH 943	SAFETY HARNESS - FULL BODY	02-Dec-09	26-Dec-09	26-Dec-09		25.00	25	R	R	R	KS0023 - 02	####		0.00	R -
2176	-	07-Dec-09	07-Dec-09	07-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
2171	-	07-Dec-09	07-Dec-09	07-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
AFBH 935	SAFETY HARNESS - FULL BODY	03-Dec-09	24-Dec-09	24-Dec-09		22.00	22	R	R	R	KS0023 - 02	####		0.00	R -
AH 1803	HAMMER 4 LBS -	03-Dec-09	03-Dec-09	03-Dec-09		1.00	1	R	R	R	KS0023 - 01	####		0.00	R -
AER 882	EXTENSION -	04-Dec-09	04-Dec-09	04-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
APL 1030	MOBI LIGHT - 200W	04-Dec-09	04-Dec-09	04-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
AH 1805	HAMMER 4 LBS -	04-Dec-09	04-Dec-09	04-Dec-09		1.00	1	R	R	R	KS0023 - 01	####		0.00	R -
AEAG 432	GRINDER ANGLE 4.5" - 4.5"	05-Dec-09	05-Dec-09	05-Dec-09		1.00	1	R	R	R	KS0023 - 01	####		0.00	R -
AER 823	EXTENSION - 220V	06-Dec-09	07-Dec-09	07-Dec-09		2.00	2	R	R	R	KS0023 - 02	####		0.00	R -
AER 883	EXTENSION -	06-Dec-09	07-Dec-09	07-Dec-09		2.00	2	R	R	R	KS0023 - 02	####		0.00	R -
APL 1043	MOBI LIGHT - 200W	06-Dec-09	06-Dec-09	06-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
ALH 143	RATCHET LEVER BLOCK 3T -	12-Dec-09	21-Dec-09	21-Dec-09		10.00	10	R	R	R	KS0023 - 01	####		0.00	R -
AAPG 143	#N/A	12-Dec-09	12-Dec-09	12-Dec-09		1.00	1	#			#N/A	####		#N/A	#N/A
AER 811	EXTENSION - 220V	15-Dec-09	15-Dec-09	15-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
AH 1803	HAMMER 4 LBS -	16-Dec-09	24-Dec-09	24-Dec-09		3.00	3	R	R	R	KS0023 - 01	####		0.00	R -
AEAG 431	GRINDER ANGLE 4.5" - 4.5"	19-Dec-09	23-Dec-09	23-Dec-09		5.00	5	R	R	R	KS0023 - 01	####		0.00	R -
AHP 042	PREP MACHINE - HISPEED AIR	19-Dec-09	20-Dec-09	20-Dec-09		2.00	2	R	R	R	KS0023 - 02	####		0.00	R -
AER 811	EXTENSION - 220V	20-Dec-09	20-Dec-09	20-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
JR32	#N/A	20-Dec-09	20-Dec-09	20-Dec-09		1.00	1	#			#N/A	####		#N/A	#N/A
SI	-	23-Dec-09	24-Dec-09	24-Dec-09		2.00	2	R	R	R	KS0023 - 02	####		0.00	R -
AEAG 430	GRINDER - 4.5" ELEC	24-Dec-09	25-Dec-09	25-Dec-09		2.00	2	R	R	R	KS0023 - 02	####		0.00	R -
AFBH 1224	SAFETY HARNESS - FULL BODY	12-Dec-09	12-Dec-09	12-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -
AER 88	EXTENSION - 220V	12-Dec-09	12-Dec-09	12-Dec-09		1.00	1	R	R	R	KS0023 - 02	####		0.00	R -

Figure 3: example of ACTOM spreadsheet

### 3. Problem statement

#### 3.1. Equipment Management

Kendall et al (1995 :48) stated that “Improvements to systems can be defined as changes that will result in incremental yet worthwhile benefits.” Thus during the problem analysis the problems were discovered with regard to the potential benefits that will be obtained by solving the problems.

There are a number of problems with this process, There is no spreadsheet or list of the equipment that is in the equipment store. If there is a request to provide details as to where all the welding machines are for example, there is no way of obtaining this data. A number of interviews were held with the managers and staff at ACTOM in order to identify the problems that they are experiancing with the process they are following and to identify their needs for the process. There were a number of problems stated by the managers and staff regarding the processes that are followed throughout the business. For the current project only problems regarding the equipment store are stated.

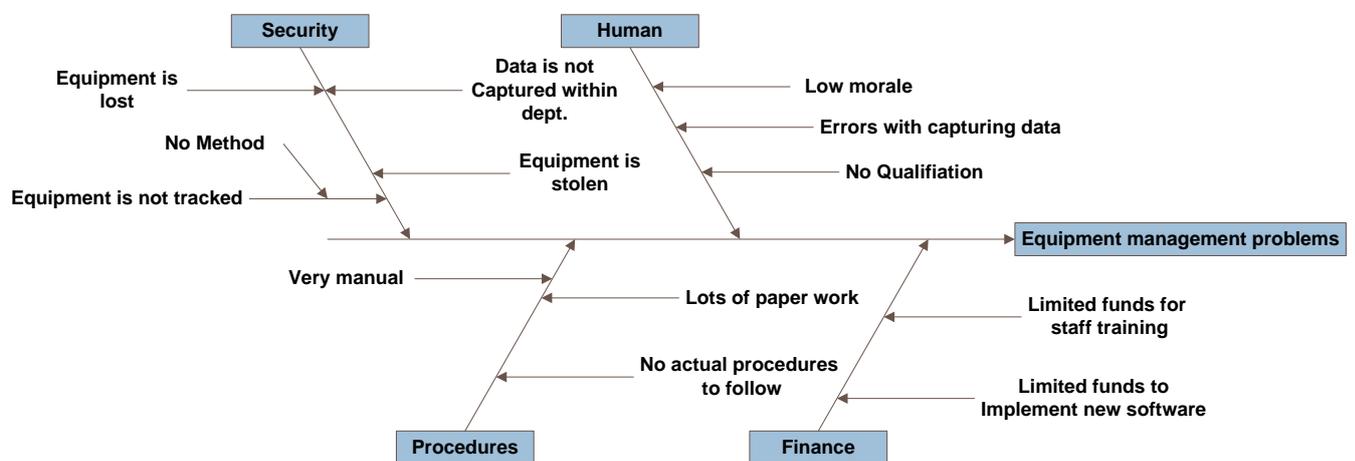


Figure 5: cause and effect analysis

### 3.1.1. Security

Security is the major problem within the equipment store. There is no method or locating equipment after it is booked onto an employee's clock number. There is an annual loss of an estimated R50 000 worth of equipment for just the Komati site. Employees are able to steal equipment by storing it in their bags and leaving the site. There are no checks performed before employees leave the site and they are able to walk out with anything that is able to fit in their bags.

Even though equipment is stolen, it shouldn't be a problem because of the procedure that ACTOM follows. This stipulates that any piece of equipment that is not returned to the equipment stores will be paid for by the employee that has booked it out. This procedure is not followed, at the end of the year all the equipment from the work sites are taken back to the equipment store. The staff at the equipment store is unable to handle the amount of equipment at once so the equipment is left in the store and it takes an estimated 4 to 5 days to check off all the equipment for the tool cards. This still doesn't indicate if anything is lost or stolen, if the equipment store were to draw up a report of what is lost or stolen, they would have to go through each tool card and check what is not signed off and make note of it.

The following are images of some of the types of equipment that is stored by the equipment store.



Figure 7: welding machine



Figure 6: Air Operated Pipe Preparation machine



Figure 8 : Air operated Angle Grinder



Figure 9: Welding Cables

There is an estimated 60 welding machines, 200 pipe preparation machines, 200 angle grinders and an unknown number of welding cables on the Komati site, this is just a few of the tools that ACTOM uses to conduct business.

### **3.1.2. Human**

The staff members that are currently employed at the equipment store have no or minimum qualifications regarding the management of equipment. The store attendant and his helper are not computer literate; this poses a problem when it comes to implementing an information system. There is little or no care with regard to equipment management.

### **3.1.3. Procedures**

With regard to procedures, the equipment store has none except that which is stated under point the project background. The managers at ACTOM have tried themselves to implement Microsoft excel spread sheets to control the equipment, but all attempts have failed.

### **3.1.4. Finance**

Funds to solve the issues within the equipment store is a problem, it needs to be stressed that by spending now there will be a greater saving in the long run. The fact that ACTOM has a loss of an estimated R50 000 per year on equipment alone should be enough to realise that there is a problem with equipment management. (Estimated figure received by ACTOM accountant)

## 4. Project Scope

The project scope will be focused on the design and development of an information system that will manage equipment at ACTOM's equipment store. The information system will address the following factors:

- The method of entering employee details
- The method of entering equipment details
- The method of assigning equipment to specific employees
- The method of issuing consumables to employees
- The integrity of the data, eliminating errors
- Reporting on the equipment availability and location
- Reporting of consumables used and available

The scope of the project will be focused on equipment management. The first part of the project will be concerned with conducting an in-depth literature review. This will entail studying the current processes and procedures that are currently in use by the equipment department. This will be a tedious task as there are very little procedures that are in place within the equipment department.

Prior to the identification and understanding of the processes and procedures, a problem analysis will be conducted to indicate the problem areas within the current processes and procedures that are used.

The requirements analysis will be the next phase of the project. The requirements analysis will indicate what the system must do, without concern to how it is done. The system users will be approached to discuss what they need or want out of the system. The requirements analysis is perhaps the most important phase in the project, as an error will result in user dissatisfaction. At the end of this phase the required processes and procedures must be identified and commercial application packages must be identified.

The decision analysis will be phase four of the project. The vendors that were identified in the requirements analysis phase will now submit quotation on the commercial application packages that they offer to suite the equipment department's needs.

After the identified vendor quotations are received, a decision will be made on which vendor is the most applicable.

In conjunction with the requirements analysis, a prototype information system will be implemented on a trial basis to aid in the determining of what the information system is required to do.

Strategic information systems planning will be conducted throughout the project. Strategic information systems planning has been defined as ‘the process of identifying a portfolio of computer-based applications that will assist an organisation in executing its business plans and realising its business goals’ (Lederer and Sethi, 1988, p446). In many organisations this type of planning includes the specification of databases and systems to support those applications (Carlson, 1979; Kerner, 1979).

Due to the fact that employees are generally not willing to change, it is important to consider the method that is used to implement an information system. If employees can be made aware of the benefits of implementing an information system, and how it will benefit them personally, then the implementation phase will be less tedious.

Maintenance of the information system will be required as well. This will be a requirement of the vendor that is selected. If something goes wrong with the information system there should be speedy support as work does not stop because of the information system not working, if it is left for too long without repair it will create a backlog of work for the store attendant.

#### **4.1.Improvement objectives and Project Aim**

The following list for possible system improvements was compiled by Kendall et al (1995:48):

- Speeding up a process;
- Streamlining a process through elimination of unnecessary or duplicated steps;
- Combining processes;
- Reducing errors in input through changes in forms and VDT screens;
- Reducing redundant output;
- Improving integration of systems and subsystems;
- Improving worker satisfaction with the system;
- Improving ease of customer, supplier, and vendor interaction with the system.

It is of utmost importance to find a means by which equipment can be booked out and in, and tracked within the various power station sites where there are ACTOM offices.

The aim of this project is thus to solve the problems stated in section 3.1 (equipment management). This must be done but taking all the technical, functional and non-functional requirements of each system user into account.

The main aim would be to identify methods of solving the security issues that the equipment department is faced with. This will reduce equipment that is lost and stolen, and in turn reduce the amount of money lost every year. Another key point to be addressed would be the usage of equipment; this will indicate the percentage usage of each item. The percentage usage data will be useful when it comes to planning power station outage periods which are very intensive on labour and equipment. The final aim of the project will be to manage the use of consumables such as welding rods, hard hats, gloves etc.

## 4.2.Expected Benefits

- Improved equipment management
  - ACTOM will be able to manage their equipment better as the information system will provide the functionality to perform this task.
  
- Cost saving
  - The initial cost of the information system and the identification technology will be far less than the losses that ACTOM is currently experiencing due to lost equipment.
  
- Information system
  - With the information system implemented there will be less paper work and this will increase the productivity of the identification system.
  - Reporting will be done much more easily, compared to the current situation where it is not possible to report on any of the equipment.
  
- Increased Profit
  - The employees that use the equipment will be able to retrieve equipment more efficiently and thus will not have to wait in lines to receive equipment. This increase in productivity of the work force will lead to increased profits.

### 4.3.Expected Challenges

➤ Funding

- Convincing managers to fund the project will be a problem, the current method of equipment management seems effecting to the managers until they have a problem of lost equipment.

➤ Lack of skill

- The staff of the equipment store is only trained to use Microsoft Excel, and some of them are not computer literate at all.

➤ System change

- The proposed system will created problems with regard to the system users, as they are not willing or are scared of change even if it is for the better.
- It will be important for management to support the system to promote the system change.

➤ User friendliness

- The system will have to be user friendly otherwise there will be complaints from the equipment store.
- Requirements analysis and the non-functional requirements by the users will aid in improving user friendliness.

## **5. Current Methods, Tools and Techniques (Literature Study)**

### **5.1.Introduction**

This literature study is a collection of information that has been acquired to express what knowledge and ideas have been established regarding the scope of this project. The literature review will also aid in making a decision on the methods that should be used for solving the problems faced.

The first and most important aspect of this project will be addressed first, the security of the equipment. Each method that is discussed will have advantages and disadvantages. The second aspect that will be discussed is the type of information system that will be relevant with regard to the stated problem. The third aspect that will be discussed is the commercial off the shelf applications (COTS) that are relevant to solving the problem that ACTOM is faced with. The final aspect will be the method of deciding which of the identification methods, information systems, and COTS will be most applicable to the problem.

### **5.2.Methods of equipment security**

There are a few methods that will be discussed under this topic:

- Bar-coding identification method
- RFID identification method
- Manual scribing method

The purpose of researching his topic is to better the identification of equipment and to increase security measures. Security is a huge problem that the equipment store is faced with and there has been little or nothing done to resolve this problem. There has been very little research done in the civil industry with regard to security of equipment, most of the security methods are widely used in the warehousing and retail sectors to improve speed and accuracy (Youssel & Salem, 2007).

### 5.2.1. Bar coding Identification method

Stated by Youseff & Salem (2007), “Barcodes have been widely used in many industrial products for automatic identification in data collection and inventory control purposes. A barcode is a machine readable representation of information in a visual format on a surface (Sutton, 2002). Stated by I.Y Soon, C.K Yeo, Y.H Sng (1999), “The use of barcodes is one of the most important developments in retail automation”. Barcodes have been widely used in many industrial products for automatic identification in data collection and inventory control purposes (Chang, Lo, & Hsieh, 1997). Barcodes originally store data in the width and spacing of printed lines but they are also able to store data in patterns of dots, concentric circles, and hidden in images. Figure 5 shows the different types of barcodes that are in use. It is well known that in many stores laser bar-code readers are used at check-out counters.” When items arrive to be scanned, the items barcode will be scanned with a barcode scanner, each label sends a unique serial code to the scanner which will interface with a information system and conduct the relevant tasks.

There is however issues regarding bar coding, unlike normal camera based picturing, if the distance between the laser reader (sensor) and the target object is too close it may result in an error in reading because the operator has to either manipulate the sensor or the object being scanned. In retail stores, this problem is easily overcome due to the fact that the objects can be rotated or the scanner is handheld (Youseff & Salem, 2007). When it comes to civil equipment, this would be a small problem because the equipment normally weights a lot and cannot be lifted. A handheld scanner would work in these applications.



Figure 10: Different types of barcodes

When a piece of equipment is first added on to a database, it will require to be manually added onto the database by scanning the barcode and entering a unique serial associated with the specific equipment.



Figure 11: Barcode scanner

Figure 6 represents a typical barcode scanner which is bound by a cord that connects to a device that is able to interpret the barcodes.



Figure 12: Wireless barcode scanner

Figure 7 represents a wireless barcode scanner that is able to transmit data over short distances. This type of scanner is very useful when it is not possible to move the object being scanned.



Figure 13: metal Barcode tag

Figure 12 is a metal barcode tag which is more durable than paper, should this method of security be implemented metal tags should be used, as paper barcodes can be removed and damaged.

Barcodes on equipment will ease the work load on the equipment store staff, and increase the level of security, but it will not be able to reduce the number of stolen items. Even though it is unable to reduce the number of stolen items, it will help to identify who booked out the item that is stolen or lost, and the procedure for stolen or lost items can be followed.

**Advantages:**

- Relatively cheap
- Reduction in item counting and identification errors
- Reduces the amount of time spent booking equipment
- No manual entering of data
- Will help with the stole or lost equipment procedure

## **Disadvantage**

- Will not aid in the theft problem
- Employees will be able to remove barcodes
- If not wireless, tedious to scan object
- Barcodes will have to be purchased

### **5.2.2. Radio Frequency Identification (RFID)**

Radio frequency identification is another method of identification. RFID systems consist of 3 parts

1. An antenna
2. The RFID tag
3. A radio frequency (RF) reader

Radio frequency identification, also known as RFID is a term for communication technology that uses radio waves to automatically identify items. There are numerous methods of identification, but the most commonly used is the storing of a unique serial number that identifies an item or person. The RFID technology can also store other information on the microchip that is contained within the tag. There is a antenna connected to the microchip, this combinations is called a RFID tag or RFID transponder. The microchip is able to transmit information with the aid of the antenna; this information is transmitted using radio waves. The reader that receives the signal transforms the radio waves into information which can be transferred to computers.

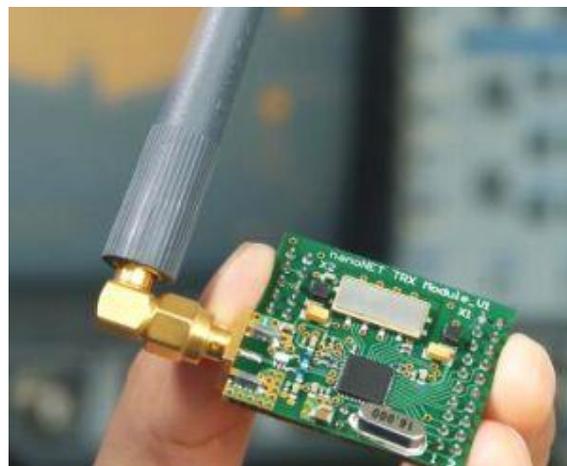
Due to the fixed high costs of RFID tags they are not widely used in industry. RFID tags are mainly used on pallets, cases of expensive goods, and any other application where the cost of the RFID tag is relative to the goods that it is protecting. (Asif & Mandviwalla, 2005).

When an item that contains a RFID tag comes into contact with a RFID reader, information is transferred from the tag to the reader. There are 2 types of tags, passive and active. Passive tags do not require any power source and are powered when in contact with the RFID reader, in a sense they rely on the energy from the reader to power themselves; the active tags require an internal power source but it requires a weaker signal from the reader to become active.

Active RFID and passive RFID are 2 different technologies, while both use radio frequency to communicate between a tag and a reader, the methods of powering the tags are different. Active tags can also contain external sensors to measure temperature, humidity, motion, and other conditions.

**Table 1: Active vs. Passive RFID tags**

	<b>Active</b>	<b>Passive</b>
<b>Power</b>	Battery operated	No internal power
<b>Required Signal Strength</b>	Low	High
<b>Communication range</b>	Long range (100m+)	Short range (3m)
<b>Data Storage</b>	Large read/write data (128kb)	Small read/write data (128b)
<b>Cost per tag</b>	R100.00 – R700.00	R1.00 – R35.00
<b>Tag size</b>	Depends on application	“sticker” to credit card size
<b>Fixed equipment costs</b>	Lower cheaper interrogators	Higher fixed readers
<b>Best area for use</b>	High volume assets moving within designated areas	High volume assets moving through fixed choke points
<b>Industries/Applications</b>	Auto dealerships Auto manufacturing Hospitals Construction Mining Laboratories Remote monitoring	Supply chain High volume manufacturing Libraries/books stores Pharmaceuticals Passports Electronic tolls Item level tracking



**Figure 14: RFID active tag**

Figure 15 and figure 16 represents a RFID active and passive tag, the active tag is quite large compared to the passive tag which is almost paper thin. Figure 17 is a representation of a label that contains a RFID passive tag; this example is very useful for identification purposes as it has a barcode on the front of the label.

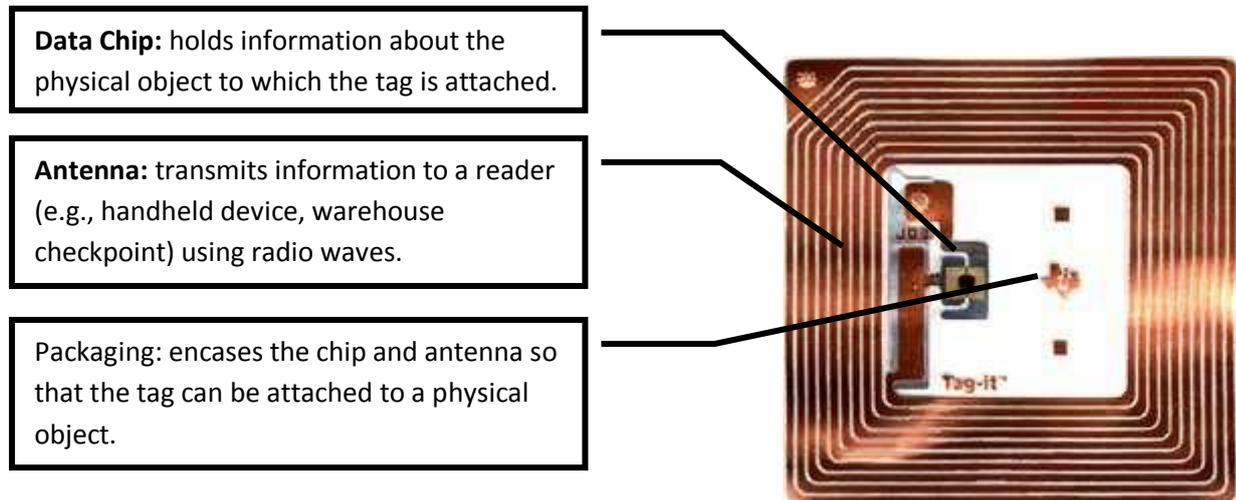


Figure 15: RFID passive tag components

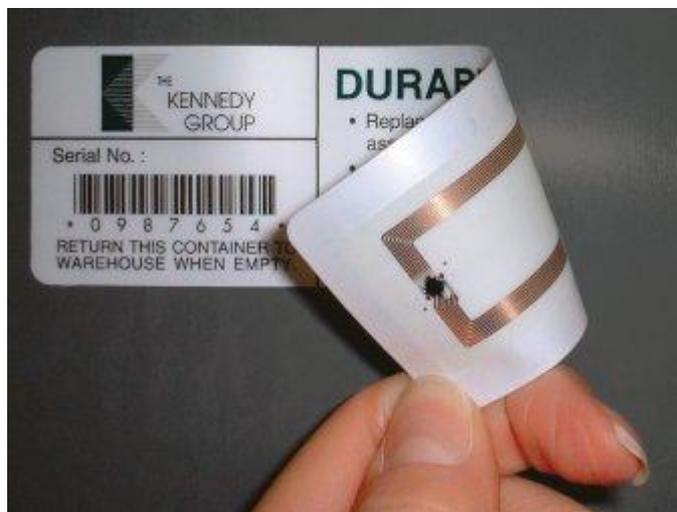


Figure 16: RFID passive tag

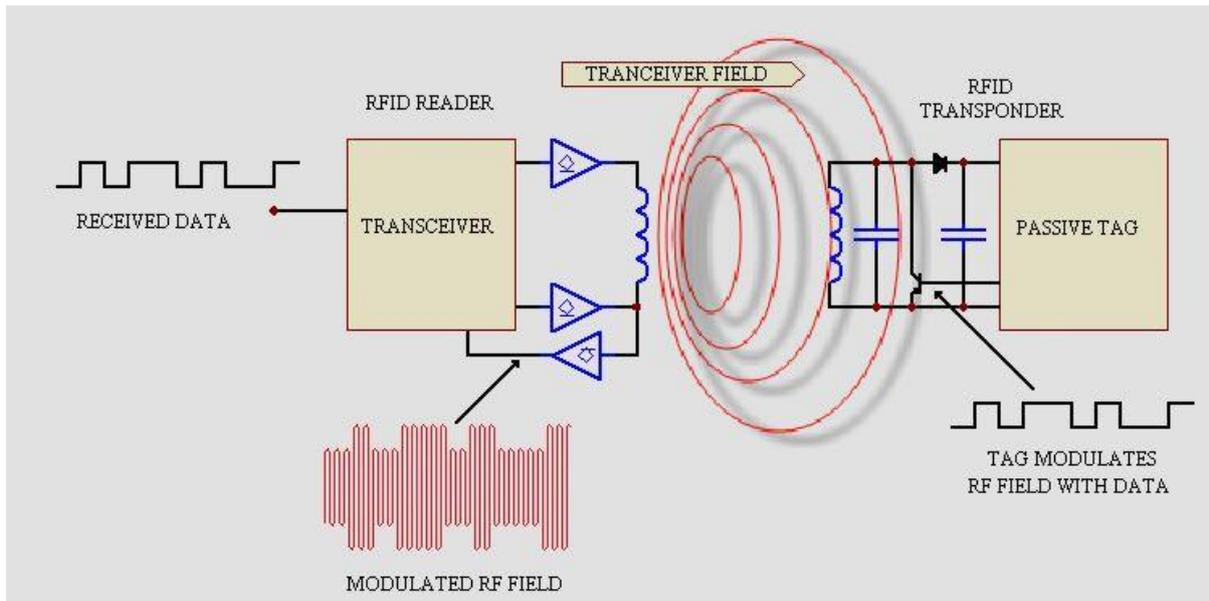


Figure 17: RFID passive tag operation

Figure 18 is a representation of how a RFID system operates with a passive tag.

The following is a detailed description of the elements of a typical RFID system, cited (McFarlane & Sheffi, 2003). These components are:

- A unique identification number assigned to each item on the system.
- A RFID tag that is attached to the item, this tag contains a data chip capable of storing, at minimum a unique identification number. This tag is capable of communicating this unique number automatically.
- RFID readers that is networked and capable of retrieving item data at high speeds. Processing of this data eliminates duplicates and errors.
- Databases that are networked and store item information.

**Advantages:**

- RFID passive tags can be read from a distance.
- The RFID tags need only be in the area of the reader for identification.
- Item numbers are unique and duplicates are not allowed
- Security is possible with the aid of readers that employees walk through before leaving site.

## Disadvantages:

- More expensive than bar-coding or manual identification.
- RFID tags may become unreadable if damaged.
- Implementation will be complex due to the type of equipment that will need tags
- Training of staff will be required.

### 5.2.3. Manual scribing of equipment

This method is used by the equipment store at present. The scribing of the equipment is done with a pneumatic pencil grinder (Figure 19). Figure 20 shows exactly how the serial number looks after it has been scribed on. This method of equipment identification is very time consuming and does not help with security issues related to equipment.



Figure 18: Pneumatic pencil grinder



Figure 19: Serial scribed on to item

**Advantages:**

- Virtually no cost for equipment identification because no additional products are needed.
- Partially effective, it is being used to control equipment.
- No implementation difficulties, because all serials are kept on paper.

**Disadvantages:**

- Time consuming when there are a large number of items.
- Errors easily occur; duplication regarding serial numbers is not unheard of.
- There is no method of securing the items after it has been scribed.

## 5.3.Information system types

### 5.3.1. Manual information systems

Manual information systems are systems that store data or information on paper or in books. This type of system is easy to use if there are no special requirements of the system. Special requirements will entail the creating of reports or calculation that is required. From observations of the equipment store it has been found that this is the type of system that ACTOM uses to manage their equipment. Interviews with the store attendant has indicated that this system is time consuming and tedious to the store attendant.

#### **Advantages:**

- Low cost due to little or no implementation and maintenance cost.
- Staff members are only required to be able to read and write, thus there are minimal qualifications required.

#### **Disadvantages:**

- Time consuming
- Calculations are not possible
- Creating reports are not possible
- Tracking equipment to employees is possible through finding the tool cards assigned to the employee
- Errors and duplications are a problem
- Automatic entry of data is not possible

### **5.3.2. Electronic Information System**

Electronic information systems are capable of capturing data and information with greater ease than the manual booking system method. Stated by Bentley et al (2007:6), “information systems in organisations capture and manage data to produce useful information that supports an organisation and its employees, and partners” with this said, an electronic information system will be a very useful tool to ACTOM’s equipment department. It will allow for the decision makers or managers to make informed decisions regarding where to transfer equipment, and what is needed where Kendall et al (1995 48).

There are 2 types of electronic information systems these are databases and spreadsheets.

#### **5.3.2.1. Databases**

There are 2 types of databases, active and passive. Active databases are used for real-time application, they monitor situations and when an event occurs that triggers the database, the relevant operations is executed.

Passive databases are those that require user interaction, and can only operate with interaction. This type of database is widely used in identification information systems where they are interfaced with identification technologies (RFID).

#### **5.3.2.2. Spreadsheets**

A spreadsheet is a combination of rows and columns of cells that are able of storing data. This method of storing data is widely used because of the availability of software. Data that is entered on to spreadsheets is subjected to errors due to human error; because of the layout of the spreadsheet it can be confusing to the user.

## **5.4. Identified commercial of the shelf applications (COTS)**

This section will identify and describe the COTS. There are numerous applications that have been developed to handle the current problem faced by ACTOM, but the applications that appeared most relevant to the problem have been stated in this section.

### **5.4.1. COTS That Addresses Check in/out**

Check IN Check OUT applications are used to track a company's assets such as equipment. These applications do so by using scanning barcodes that are placed on the assets and that are entered into the application database. The following are 2 COTS application that have been identified, will solve the problem of unaccountability of equipment at ACTOM.

#### **5.4.1.1. Redbeam Check in/out Asset Tracking Software Application**

RedBeam Check-in/Check-out software is a program allowing companies to effectively keep track of company equipment, tools, file folders as well as samples of products and rental items. RedBeam Check-in/Check-out keeps track of any items that have revolving ownership or possession. Many companies require that their assets such as equipment, tools and files be kept secure to prevent theft. RedBeam Check-in/Check-out software will ensure every item is tracked and therefore keeping valuable items and classified information safe and secure.

RedBeam Check-in/Check-out software is available in a standard version as well as a mobile version. The standard edition allows data to be captured using cabled barcode scanners attached to a fixed computer workstation. The mobile edition allows data to be captured also by using the cabled barcode scanners attached to the fixed workstation as well as the ability to collect data on scanner-enabled mobile workstations such as laptops and handheld tablet computers.

Check-in/Check-out software supports Windows XP, Serer 2003 and Windows Vista.

The standard version of this powerful software is a complete item database with the ability to use cabled barcode scanners attached to fixed computer workstations. With this edition, you can enter employees, members, customers and students into the system and then track equipment, tools and files folders by checking them in or out using the cabled barcode scanner. When the time comes to check who has checked out an item, the user friendly interface allows you check with just one click. This system will allow you to monitor items, rental fees, item usage and much, much more.

In order to keep track of items, each item will need to be bar-coded. You can barcode all equipment, tools, file folders, employee member cards, customer cards and even student cards. All RedBeam Check-in/Check-out tracking software comes with a pack of blank barcode labels that can be printed on any standard laser printer.

Tracking is made very simple with Check-in/Check-out software. Simply scan or enter the ID of the person checking out an item. After that step is complete, scan the item that they are checking out. In the case of rental fees, they can be charged for at the time of check out. When an item is returned, scan the item back in. When there are overdue fees, they can be charged during check in.

RedBeam Check-in/Check-out software gives you total control over all your assets. You can run reports that show you which items are checked out and also who checked them out. View overdue items, item usage by person or department, rental and overdue fee value and transaction history.

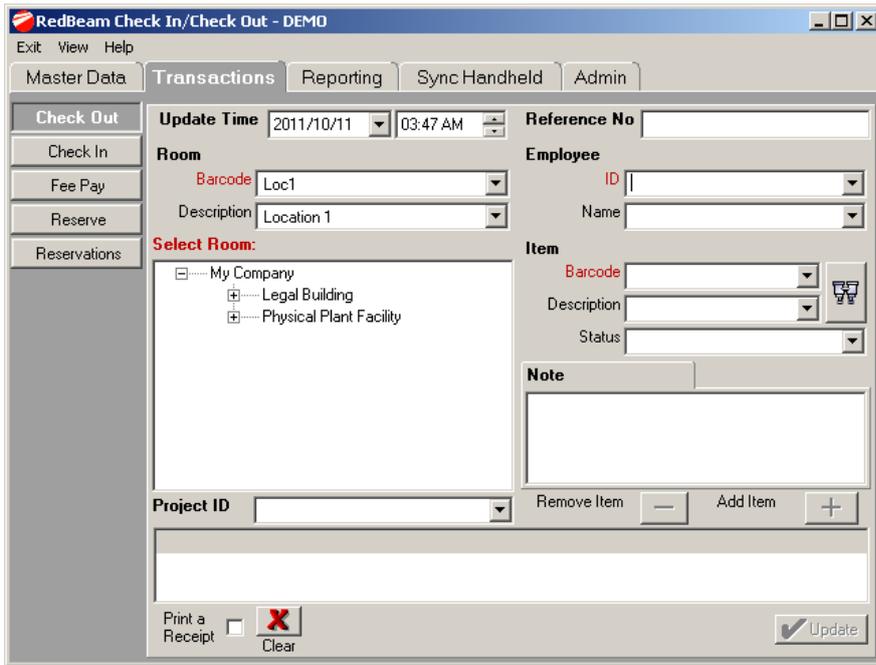


Figure 20: Redbeam screenshot (check OUT)

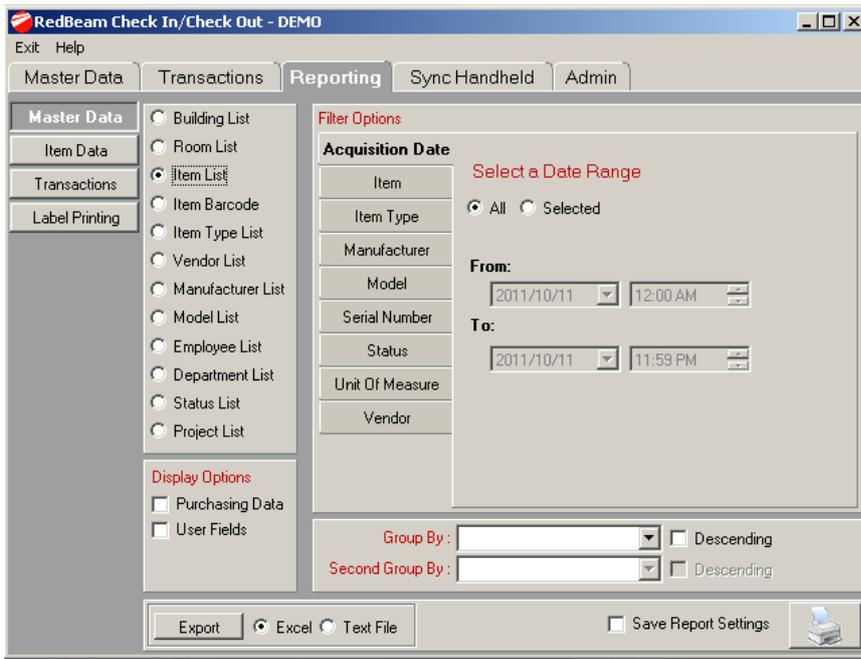


Figure 21: Redbeam screenshot (reports)

#### 5.4.1.2. Intellitrack Check IN Check OUT Software Application

IntelliTrack Check-in/Check-out software allows Equipment and Tool Managers as well as Facility Maintenance Managers to track equipment and consumable inventory. IntelliTrack tracking software allows the user to check and track equipment availability in addition to

consumable inventory usage and stock levels. By using a windows CE/Mobile handheld computer with the integrated barcode reader, personnel can quickly check out equipment or receive and issue consumable inventory.

To use the IntelliTrack system, you will need to scan the location barcode, item barcode and enter the transaction quantity using the Windows CE/Mobile handheld computer. Information that is stored on IntelliTrack includes who has checked out the item, the duration that it will be checked out and when the item is due back. If your items are not bar-coded, IntelliTrack can print one out for the specified item.

IntelliTrack software is used to track tools, IT and audio visual equipment. IntelliTrack is very popular with manufacturing, municipalities, construction, police departments, fire departments, building maintenance and office supply departments. Accurate inventory control is a key strategy in controlling loss, maintenance and supply costs.

Features of IntelliTrack Check-in/Check-out software:

- Includes both PC and handheld computer software.
- Runs on Windows XP, Windows Vista, Windows 7, Server 2003 and 2008 all 32 or 64 bit systems.
- Based on Microsoft SQL Server
- PC application for configuration, management and reporting
- Import and export capabilities
- Supports multiple sites or buildings
- Supports standard reports and custom reports when running a full version of Access 2007
- Supports most popular Windows CE/Mobile handheld computers with RFID readers.
- Handheld computer application for scanning location and item barcodes during the check in, check out, receipt and issue processes.

#### **5.4.1.3. Primasoft Equipment/Tool Organizer Pro**

Primasoft Equipment/Tool Organizer Pro is a check-in/check-out software program that allows the user to easily catalogue, organize, manage and track all your equipment/tool items

and process check-in and check-out transactions. This simple program can be used as an inventory database for companies, schools, institutions and public facilities that want to track tool/equipment movement.

Equipment/Tool organizer Pro is designed to manage the following activities of your equipment management facility:

- Organize, catalogue and manage all your equipment and tools
- Track equipment availability
- Organize the people that borrow equipment such as employees, members, personnel, students, job sites etc.
- Assign tools and equipment to employees, members, personnel, students, job sites, storage places.
- Keep track of the equipment/tool circulation data.
- Track maintenance, service and repair transactions.
- Print circulation reports, print barcode labels and print ID cards.

The trial version of this product allows you to track and circulate individual items. The Pro version allows you to check items in and out in multiple quantities.

The following databases are included in the Equipment/Tool Pro software:

- Equipment/Tools: Simple inventory database solution that allows you to catalogue, manage and track your equipment.
- Employees/Jobs: Enter information about all employees and borrowers who will loan equipment and tools
- Maintenance: Easy to use database for the recording maintenance transactions
- Loan Database: Records automatically all check-in and check-out transactions

Benefits from using Equipment/Tool Pro:

- Simple, easy to use: There are ready to use templates and the user friendly interface let you easily and quickly manages your equipment and tool inventories.
- Quickly access your inventory items data: You can access and view your equipment and tools data in virtually any way. There is also a table viewer that allows you to view data in rows and columns. Browser Viewer allows you to view data in virtually

any way browser viewer. Standard record viewers allow you to easily enter and modify inventory items data or quickly generate data specific commands.

- Easily process data: The built in wizards let you create quality, professionally looking documents, equipment inventory reports, tool movement summaries, inventory catalogues, labels with barcode and graphics.
- Learn once use multiple times: You can use application for all your database needs. You can create your own tool/equipment inventory solution.

## **5.4.2. COTS That Address Inventory Control**

Inventory control applications will be used to control the use of consumables at ACTOM, there is no software that has been designed specifically to address civil consumable inventory control so generic inventory control applications have been identified.

### **5.4.2.1. RedBeam Inventory Control Software Application**

RedBeam Inventory Tracking makes inventory control easy. RedBeam Inventory Tracking control software will help you control your inventory levels and item movements in your warehouse, distribution centre, stock room or store. RedBeam Inventory Tracking software will streamline your inventory tracking and physical inventory process track serial numbers, lot numbers and expiration dates.

RedBeam Inventory Tracking software is available in a standard version as well as a mobile version. The standard edition allows data to be captured using cabled barcode scanners attached to a fixed computer workstation. The mobile edition allows data to be captured also by using the cabled barcode scanners attached to the fixed workstation as well as the ability to collect data on scanner-enabled mobile workstations such as laptops and handheld tablet computers.

RedBeam Inventory Tracking software supports Windows XP, Serer 2003 and Windows Vista.

The standard version of this powerful software is a complete item database with the ability to use cabled barcode scanners attached to fixed computer workstations. Control inventory through receive, move, issue and adjust transactions on the fixed desktop workstation by scanning items with a cabled barcode scanner or by entering data manually. Print count sheets and take periodic physical inventories. Run inventory, recorder, out of stock, overstock and transaction reports.

#### **5.4.2.2. Intellitrack Inventory Management Software Application**

IntelliTracks Inventory management system is designed for a variety of situations. IntelliTracks software is made of two different product lines being Data management Software and Warehouse Management Systems. Each software package contains a variety of inventory tracking capabilities. Depending upon the size and complexity of your operations, IntelliTrack has a system for you.

#### **5.4.2.3. PrimaSoft Stockroom Organiser Pro**

PrimaSoft's Stockroom Organiser Pro for Windows is an easy to use stockroom inventory management software for a small warehouse or storage facility. This software gives an easy way to catalogue, manage and track all your items and process incoming and outgoing transactions. For the database novice, Organizer's intuitive interface and ready to use stockroom inventory management solutions make it easy to set up and use.

## 5.5. Decision matrices

The following decision matrices will be used to evaluate the identification methods and the commercial off the shelf products (COTS):

- Candidate system matrix. This matrix will compare the following characteristics of the identified candidate systems:
  - Portion of system computerization.
  - Benefits.
  - Servers and workstations.
  - Software tools needed.
  - Application software.
  - Method of data processing.
  - Output devices and implications.
  - Input device and implications.
  - Storage device and implications.

Characteristics	Candidate 1	Candidate 2	Candidate 3	Candidate ...
<b>Portion of System Computerized</b> Brief description of that portion of the system that would be computerized in this candidate.	COTS package Platinum Plus from Entertainment Software Solutions would be purchased and customized to satisfy Member Services required functionality.	Member Services and warehouse operations in relation to order fulfillment.	Same as candidate 2.	
<b>Benefits</b> Brief description of the business benefits that would be realized for this candidate.	This solution can be implemented quickly because it's a purchased solution.	Fully supports user required business processes for SoundStage Inc. Plus more efficient interaction with member accounts.	Same as candidate 2.	
<b>Servers and Workstations</b> A description of the servers and workstations needed to support this candidate.	Technically architecture dictates Pentium Pro, MS Windows NT class servers and Pentium, MS Windows NT 4.0 workstations (clients).	Same as candidate 1.	Same as candidate 1.	
<b>Software Tools Needed</b> Software tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages, etc.). Not generally applicable if applications software packages are to be purchased.	MS Visual C++ and MS Access for customization of package to provide report writing and integration.	MS Visual Basic 5.0 System Architect 3.1 Internet Explorer	MS Visual Basic 5.0 System Architect 3.1 Internet Explorer	
<b>Application Software</b> A description of the software to be purchased, built, accessed, or some combination of these techniques.	Package Solution	Custom Solution	Same as candidate 2.	
<b>Method of Data Processing</b> Generally some combination of: on-line, batch, deferred batch, remote batch, and real-time.	Client/Server	Same as candidate 1.	Same as candidate 1.	
<b>Output Devices and Implications</b> A description of output devices that would be used, special output requirements (e.g., network, preprinted forms, etc.), and output considerations (e.g., timing constraints).	(2) HP4MV department laser printers (2) HP5SI LAN laser printers	(2) HP4MV department laser printers (2) HP5SI LAN laser printers (1) PRINTRONIX bar-code printer (includes software & drivers)  Web pages must be designed to VGA resolution. All internal screens will be designed for SVGA resolution.	Same as candidate 2.	
<b>Input Devices and Implications</b> A description of input methods to be used, input devices (e.g., keyboard, mouse, etc.), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs).	Keyboard & mouse	Apple "Quick Take" digital camera and software (15) PSC Quickscan laser bar-code scanners (1) HP Scanjet 4C Flatbed Scanner Keyboard & mouse	Same as candidate 2.	
<b>Storage Devices and Implications</b> Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used, how much storage capacity would be needed, and how data would be organized.	MS SQL Server DBMS with 100GB arrayed capability.	Same as candidate 1.	Same as candidate 1.	

Figure 22: Framework of candidate system matrix

- Feasibility analysis matrix. This matrix will compare the following characteristics of the identified candidate systems and rank them on those characteristics:
  - Operational feasibility
  - Technical feasibility
  - Economic feasibility
  - Schedule feasibility

Other characteristics that are important to the equipment department will also be analysed.

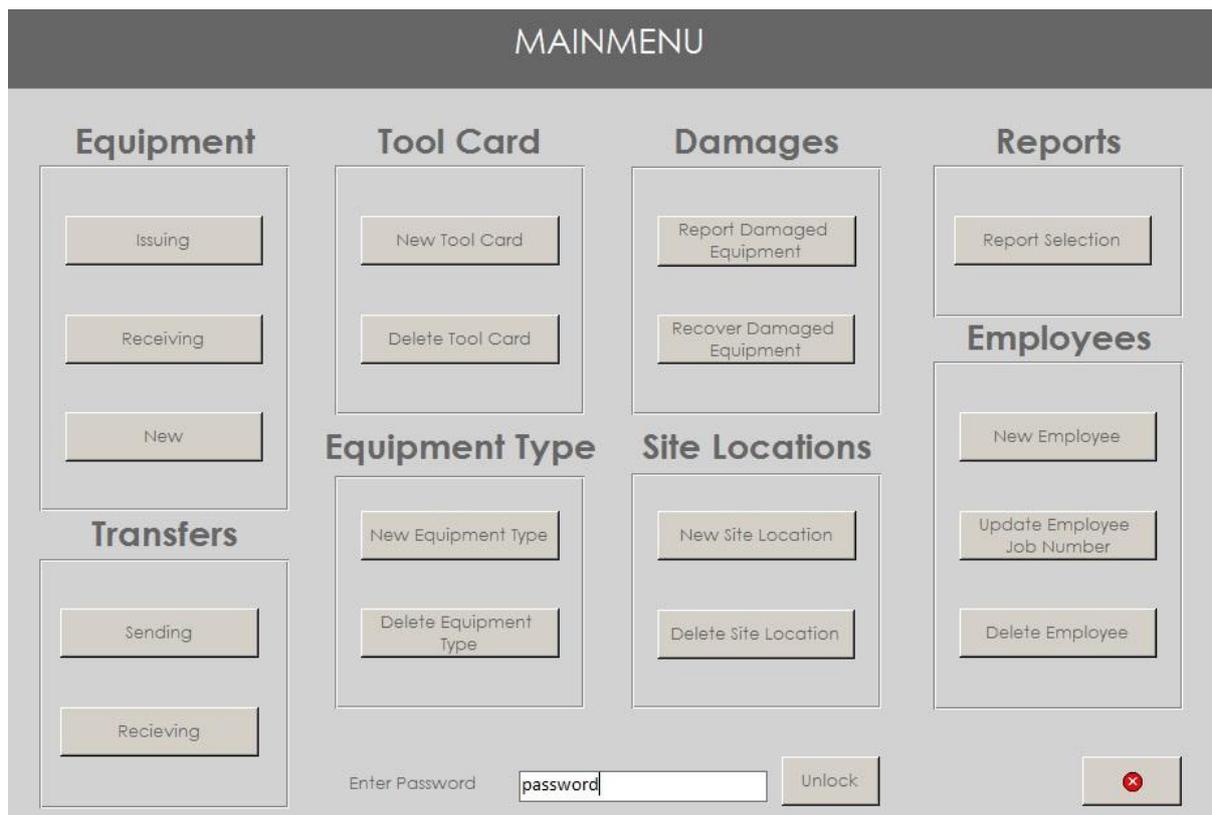
Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3	Candidate . . .
<b>Operational Feasibility</b>  <b>Functionality.</b> A description of to what degree the candidate would benefit the organization and how well the system would work.  <b>Political.</b> A description of how well received this solution would be from both user management, user, and organization perspective.	30%	Only supports Member Services requirements and current business processes would have to be modified to take advantage of software functionality  <b>Score: 60</b>	Fully supports user required functionality.  <b>Score: 100</b>	Same as candidate 2.  <b>Score: 100</b>	
<b>Technical Feasibility</b>  <b>Technology.</b> An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate.  <b>Expertise.</b> An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.	30%	Current production release of Platinum Plus package is version 1.0 and has only been on the market for 6 weeks. Maturity of product is a risk and company charges an additional monthly fee for technical support.  Required to hire or train C++ expertise to perform modifications for integration requirements.  <b>Score: 50</b>	Although current technical staff has only Powerbuilder experience, the senior analysts who saw the MS Visual Basic demonstration and presentation have agreed the transition will be simple and finding experienced VB programmers will be easier than finding Powerbuilder programmers and at a much cheaper cost.  MS Visual Basic 5.0 is a mature technology based on version number.  <b>Score: 95</b>	Although current technical staff is comfortable with Powerbuilder, management is concerned with recent acquisition of Powerbuilder by Sybase Inc. MS SQL Server is a current company standard and competes with SYBASE in the Client/Server DBMS market. Because of this we have no guarantee future versions of Powerbuilder will "play well" with our current version SQL Server.  <b>Score: 60</b>	
<b>Economic Feasibility</b>  <b>Cost to develop:</b>  <b>Payback period (discounted):</b>  <b>Net present value:</b>  <b>Detailed calculations:</b>	30%	Approximately \$350,000.  Approximately 4.5 years.  Approximately \$210,000.  See Attachment A.  <b>Score: 60</b>	Approximately \$418,040.  Approximately 3.5 years.  Approximately \$306,748.  See Attachment A.  <b>Score: 85</b>	Approximately \$400,000.  Approximately 3.3 years.  Approximately \$325,500.  See Attachment A.  <b>Score: 90</b>	
<b>Schedule Feasibility</b>  An assessment of how long the solution will take to design and implement.	10%	Less than 3 months.  <b>Score: 95</b>	9–12 months  <b>Score: 80</b>	9 months  <b>Score: 85</b>	
<b>Ranking</b>	100%	60.5	92	83.5	

Figure 23: Framework of feasibility analysis matrix

## 6. Problem solving (Logical Design)

### 6.1.Rapid Application Development

To aid with the requirements analysis, an application was developed in Microsoft Access 2007 and has been used by the equipment store for the past six months. The application makes use of manual entry of the data (equipment serial numbers, employee details, etc.). The application was able to meet most of the requirements of the equipment store, but it was identified that there was a requirement for faster user data entry. The following figures are screen shots of the application. The application was designed to run parallel to the current method used by the equipment store, thus the addition of tool card numbers was required within the application.



## Equipment Issuing

Serial Number	<input type="text"/>
Toolcard Number	<input type="text"/>
Equipment Type	<input type="text"/>
Date Issued	2010/07/01
Clock Number	<input type="text"/>
Initials	<input type="text"/>
Surname	<input type="text"/>

## Equipment Recieving

Serial Number	<input type="text"/>
<b>Returned to store</b>	
Equipment Type	<input type="text"/>
Date Returned	2010/07/01

## 6.2. Requirements Analysis

A requirements analysis was conducted by gathering the following information:

- Rapid application prototyping
- Tools cards that are used for entering records
- Equipment control spreadsheets
- Equipment lists
- functional requirements
- non-functional requirements

The outputs of the requirements analysis phase are the following:

- Purpose of the system
- Stakeholders
- Functional requirements
- Non-functional requirements
- System users
- Use case diagrams
- Entity relationship diagram
- Data-to-process CRUD matrix
- Context data flow diagram

## 6.3. Purpose of the system

The purpose of the information system is to improve the operation of the equipment store at ACTOM by using an information system that interfaces with RFID readers to read data from equipment that have RFID tags in the form of labels. This will improve equipment identification and tracking.

## **6.4. Stakeholders**

The stakeholders of the system are the ACTOM managers who will be requesting the reports that the system produces and the equipment store employees that will be the users of the system. This system will allow for an increase in the efficiency of the equipment store. The employees that book the equipment out are also seen as secondary stakeholders.

## **6.5. Functional requirements**

The following is a list of functional requirements of the information system and identification technology:

- Ability to enter employee details
- Ability to enter equipment details
- Ability to enter site location details
- Ability to link employees to equipment
- Ability to create reports
- Ability to identify equipment uniquely
- System must be reliable

## **6.6. Non-Functional requirements**

- User friendly
- Reduce data entry errors
- Minimize data entry time
- must contain a user manual
- users must be trained
- data should be limited to certain users

## **6.7. System users**

The system users will be the store attendant and his helper, and the 2 clerks that are in charge of maintaining the employee and equipment information.

## **6.8. Requirements Use Case Diagrams**

Use case diagrams are frequently used in object oriented design as a diagram that depicts the interactions between the system, its users, and external systems Bentley et al (2007:6).The requirements use case diagrams indicate each of the systems actor's and user's roles. The system is broken down in to subsystems which group the processes. The actors and users initiate the processes stated within the subsystems. Refer to appendix B for requirements use case diagram.

## **6.9. Entity Relationship Diagram (ERD)**

The entity relationship diagram illustrates the data model of the system. The entities in the ERD are related to the Microsoft Access 2007 database. Refer to appendix C for the ERD.

## **6.10. Data-to-Process-CRUD Matrix**

The Data-to-process CRUD matrix links the use case processes with the entity attributes in the ERD. Refer to appendix D for the Data-to-process CRUD matrix.

C – Create

R – Read

U – Update

D – Delete

## **6.11. Context Data Flow Diagram (DFD)**

The context data flow diagram is used to illustrate what data flows into and out of an information system. The system is often noted as the black box that external agents act upon with inputs and outputs. Refer to appendix E for the context data flow diagram.

## 7. Decision analysis

### 7.1.1. Trade-off Study between Identification Methods

Criteria	Weight	RFID	Bar Coding	Manual data entering
<b>Time taken to enter data</b>	30	Data is entered using a RFID reader, Almost instantaneous <b>30 points</b>	Data is entered using a barcode scanner, very fast. <b>25 points</b>	User has to enter serial number manually into application, very long. <b>5 points</b>
<b>Amount of skill required to operate technology</b>	30	Operators need to be extensively trained to operate the equipment; high level of skill is required. <b>10 points</b>	Operators are required to use barcode scanners, very little skill required. <b>20 points</b>	Operators manually enter data, typing skills are required. <b>25 points</b>
<b>Technology Setup cost</b>	10	Professionals are required to setup software and integrate it in to the system; tags are required to be programmed as well. Very expensive. <b>2 points</b>	Initial software, barcode scanner and printer required, low cost. <b>8 points</b>	Setup of tracking software, input is done manually. No cost. <b>10 points</b>
<b>Maintenance cost</b>	10	RFID Technology is new and will require a lot of maintenance, very high maintenance cost. <b>1 point</b>	Bar-coding technology is widely used in asset tracking and will require minimal maintenance as the technology has been perfected over years, low maintenance cost. <b>8 points</b>	Operator data entry errors will cause repeated maintenance, high maintenance cost. <b>5 points</b>
<b>Consumables cost</b>	10	RFID passive tags in South Africa range from R15 to R100. The cost of tagging an estimated 5000 assets would be massive. Very expensive consumable cost. <b>2 points</b>	The only consumable that is required is the paper used by the barcode printer. Very low cost. <b>8 points</b>	No consumables. <b>10 points</b>
<b>Current application of technology in asset tracking</b>	10	RFID technology is not widely used in equipment asset tracking within South Africa. <b>3 points</b>	Bar-coding technology is widely used by retail stores to civil construction applications. <b>8 points</b>	Most companies are moving away from manual data entry as it is known to come with a lot of human error. <b>4 points</b>
<b>Total Points</b>	<b>100</b>	<b>46</b>	<b>77</b>	<b>59</b>

Table 2: Trade-off Study between Identification Methods

From the data obtained from the trade-off matrix, it can be seen that bar coding is the most applicable identification method to address the problem.

### 1.1.1. Trade-Off analysis between COTS

The following is a trade- off analysis between the above mentioned commercial off the shelf applications (COTS) to determine which of the software applications best suits the needs of the system. The trade-off analysis will be done by using a candidate system matrix and a candidate feasibility matrix. The check IN check OUT software will be used for equipment management, and the inventory management software will be used to manage the consumables. Due to the fact that none of the COTS offer both check IN check OUT and Inventory control capabilities, there will be 2 sets of trade-off analysis, one for check IN check OUT and one for inventory control.

#### 1.1.1.1. Candidate system matrix's

Equipment Check In/Out software applications			
Characteristics	Red beam check in/out	Intellitrack check in/out	Primasoft Equipment/Tool Organizer Pro
<b>Portion of system computerized. Brief description of the system that would be computerised in this candidate</b>	This package uses Microsoft Access while incorporating Microsoft Visual C++. Purchased as a fully functioning.	This application utilizes Microsoft Access and Visual Basic. System can be customized to meet specific user needs.	Member Services and warehouse operations in relation to order fulfilment.
<b>Benefits. Brief description of the business benefits that would be realised for this candidate</b>	This solution can be bought as one fully functioning unit and therefore can be implemented immediately.	Efficient implementation, easy setup, supports user requirements.	This solution fully supports user requirements. Very efficient with member accounts.

<b>Servers and workstations. A description of the servers and workstations needed to support this candidate</b>	Windows XP, Windows Server 2003 or 2008, Windows Vista, Windows 7 32/64 bit.	Same as RedBeam Check-in/Check-out.	Same as RedBeam Check-in/Check-out.
<b>software and tools needed. Software tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages, etc.).</b>	Microsoft Access 2007 or later, Internet Explorer 6.0, Microsoft Visual C++, System Architect 3.1.	Microsoft Access 2007 or later, Internet Explorer 6.0, Microsoft Visual C++ for added customisation, System Architect 3.1.	Microsoft Access 2007 or later, Internet Explorer 6.0, Microsoft Visual C++ for added customisation and integration, DirectX.
<b>Application software. A description of the software to be purchased, built, accessed, or some combination of these techniques</b>	Package solution	Package Solution. Semi-customizable solution.	Package Solution. Semi-customizable solution.
<b>Method of processing. Generally some combination of: online, batch, remote batch, and real-time.</b>	Real time Client/Server	Real time Client/Server	Real time Client/Server
<b>Output devices and implications. A description of output devices that would be used, special output requirements (e.g., network, pre-printed forms, etc.), and output considerations (e.g., time constraints)</b>	Computer monitor. Laser printers. RedBeam User interface.	Computer monitor. Laser printers. IntelliTrack User interface.	Computer monitor. Laser printers. PrimaSoft User interface.

<p><b>Input devices and implication. A description of input methods to be used, input devices (e.g., keyboard, mouse, etc.), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs)</b></p>	<p>Keyboard, mouse, cabled barcode reader, facial scan.</p>	<p>Keyboard, mouse, cabled barcode reader, mobile cabled barcode reader, retina scan.</p>	<p>Keyboard, mouse, cabled barcode reader, mobile cabled barcode reader, voice recognition, retina scan, thumb print scanner.</p>
<p><b>Storage devices and implications. Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used, how much storage capacity would be needed, and how data would be organised.</b></p>	<p>Microsoft SQL Server DBMS 1 Terabyte arrayed capability.</p>	<p>Same as RedBeam Check-in/Check-out.</p>	<p>Microsoft SQL Server DBMS 2 Terabyte arrayed capability.</p>

Table 3: candidate matrix

<b>Consumables inventory software applications</b>			
<b>Characteristics</b>	<b>Red beam inventory control software</b>	<b>Intellitrack inventory software</b>	<b>Stockroom Organizer Pro, v2.7</b>
<b>Portion of system computerized. Brief description of the system that would be computerised in this candidate</b>	This package utilizes Microsoft Access and Microsoft SQL in order to store the contents of the inventory in a database.	This solution requires Microsoft Access and Visual C++. System can be customized to meet user specified requirements.	Same as IntelliTrack inventory Software.
<b>Benefits. Brief description of the business benefits that would be realised for this candidate</b>	Simple to use. Implementation is immediate. Do not need to employ a very highly skilled worker to operate the program.	Efficient implementation, easy setup, supports user requirements.	This solution fully supports user requirements. Very efficient with member accounts.
<b>Servers and workstations. A description of the servers and workstations needed to support this candidate</b>	Windows XP, Windows Server 2003 or 2008, Windows Vista, Windows 7 32/64 bit.	Same as RedBeam inventory control software.	Same as RedBeam inventory control software.
<b>Software and tools needed. Software tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages, etc.).</b>	Microsoft Access 2007 or later, Internet Explorer 6.0, Microsoft Visual C++, System Architect 3.1.	Microsoft Access 2007 or later, Internet Explorer 6.0, Microsoft Visual C++ for added customisation, System Architect 3.1.	Microsoft Access 2007 or later, Internet Explorer 6.0, Microsoft Visual C++ for added customisation and integration, DirectX.
<b>Application software. A description of the software to be purchased, built, accessed, or some combination of these techniques</b>	Package solution	Package Solution. Semi-customizable solution.	Package Solution. Fully-customizable solution.
<b>Method of processing. Generally some combination of: online, batch, remote batch, and real-time.</b>	Real time Client/Server	Real time Client/Server	Real time Client/Server

<p><b>Output devices and implications. A description of output devices that would be used, special output requirements (e.g., network, pre-printed forms, etc.), and output considerations (e.g., time constraints)</b></p>	<p>Computer monitor. Laser printers. RedBeam inventory control user interface.</p>	<p>Computer monitor. Laser printers. IntelliTrack inventory control user interface.</p>	<p>Computer monitor. Laser printers. PrimaSoft inventory control user interface.</p>
<p><b>Input devices and implication. A description of input methods to be used, input devices (e.g., keyboard, mouse, etc.), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs)</b></p>	<p>Keyboard, mouse, employee ID card, thumb print scanner.</p>	<p>Keyboard, mouse, employee ID card, retina scan, thumb print scanner.</p>	<p>Keyboard, mouse, employee ID card, retina scan, thumb print scanner, facial scanner.</p>

Table 4: candidate matrix

### 1.1.1.2. Candidate Feasibility Matrix's

Equipment Check In/Out software applications				
Feasibility Criteria	Weight	Red beam check in/out	Intellitrack check in/out	Primasoft Equipment/Tool Organizer Pro
<b>Operational Feasibility.</b>		Supports Member services requirements as well as current business processes. A lot of modification needed to meet user specific requirements.	This solution fully supports user required functionality.	Same as IntelliTrack check-in/check-out.
<b>Functionality. A description of to what degree the candidate would benefit the organisation and how well the system would work.</b>				
<b>Political. A description of how well received this solution would be from user management, user, and organisation perspective.</b>				
<b>Score</b>	30%	50	80	90
<b>Technical feasibility.</b>		This product is readily available. All functions are built into the program. Simple to install and operate. Very user friendly.	This software is readily available and will run on all major operating systems with minimal maintenance.	This solution can run on any system. It has very complex internal features that are not easily understandable by inexperienced programmers.
<b>Technology. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate.</b>				
<b>Expertise. An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.</b>				
<b>Score</b>	30%	90	65	65
<b>Economic Feasibility.</b>		R13931.65 Refer to appendix A for DCI quote	R20476.90 price obtained from international website	R8703.50 price obtained from international website
<b>Cost to purchase.</b>				

<b>Score</b>	30%	50	40	80
<b>Schedule Feasibility</b>		Already developed	Already developed	Already developed
<b>Score</b>	10%	100	100	100
<b>Ranking</b>	100%	67	65.5	80.5

Table 5: feasibility matrix

<b>Consumables inventory software applications</b>				
<b>Feasibility Criteria</b>	<b>Weight</b>	<b>Red beam Inventory control</b>	<b>Intellitrack Inventory control</b>	<b>Stockroom Organizer Pro, v2.7</b>
<b>Operational Feasibility.</b>				
<b>Functionality. A description of the degree the candidate would benefit the organisation and how well the system would work.</b>		Supports Member services requirements as well as current business processes. A lot of modification needed to meet user specific requirements.	This solution fully supports user required functionality.	Same as IntelliTrack inventory control software.
<b>Political. A description of how well received this solution would be from user management, user, and organisation perspective.</b>				
<b>Score</b>	30%	50	80	90
<b>Technical feasibility.</b>				
<b>Technology. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate.</b>		This product is readily available. All functions are built into the program. Simple to install and operate. Very user friendly.	This software is readily available and will run on on all major operating systems with minimal maintenance.	This solution can run on any system. It has very complex internal features that are not easily understandable by inexperienced programmers.
<b>Expertise. An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.</b>		Simple to install and operate. No experienced programmers needed to maintain the system.	In order to maintain and customize this solution, the user should have some basic knowledge on how to program.	In order to fully customize this system, the user will need a high level of knowledge in programming.
<b>Score</b>	30%	90	65	65

<b>Economic Feasibility.</b>				
<b>Cost to purchase.</b>		R5600 DCI Quotation	R9611.76 price obtained from international website	R2577.45 price obtained from international website
<b>Score</b>	30%	50	40	80
<b>Schedule Feasibility</b>		Already developed	Already developed	Already developed
<b>Score</b>	10%	100	100	100
<b>Ranking</b>	100%	67	65.5	80.5

Table 6: feasibility matrix

## **8. Solution Approach**

### **8.1.Solution Selection**

From the research documented in the literature review it can be seen that the use of an information system will solve the problem faced by the equipment store. The candidate information systems have been ranked and recommendations can be made regarding check IN/OUT and inventory control software applications.

With regard to check IN/OUT of equipment the Primasoft equipment/tool organiser software package has been selected as it meets the major requirements of the information system. The equipment/tool organiser application will be used to track and control the equipment. With regard to inventory control the Primasoft organiser pro has been selected. The organiser pro application will be used to control and monitor the use of consumables. The equipment/tool organiser software applications will make use of bar coding technology to identify the different types of equipment.

The Microsoft Access 2007 database is capable of meeting the minimal requirements of the equipment store. It will make use of manual data entry; this is due to the fact that barcode readers were not available to perform testing. Should the equipment store make use of the Microsoft access 2007 database, the relevant information technology technicians should be trained to perform maintenance on the information system.

## 9. Conclusion

The aim of the project was to solve the problem of unaccountability of lost and stolen equipment and to be able control consumable stock levels through the use of an information system.

Several problems have been identified with the system in place and the processes that the ACTOM equipment store follows. Research was required to determine how the problems that were found should be solved. This research was done with the aid of literature review.

Three item identification methods were discussed and the most appropriate technology appears to be the bar coding identification method. The different types of information systems were also discussed, databases were found to be superior to spreadsheets with regard to the problem at hand.

Three check in/out software application were research and the most appropriate application was selected, three inventory control software application were also researched and the most appropriate was also selected.

The prototype information system will be presented to the mentor at ACTOM with the database manual.

## 10. Appendices

### Appendix A

	DC Industrial Scanning Systems (PTY) LTD Reg No. 1995/008450/07 1 Hennie Alberts Street BRACKENHURST 1448 P.O. Box 166840 BRACKENDOWNS 1454 SOUTH AFRICA Tel: (27) (11) 867-1449 Fax: (27) (11) 867-1001  <a href="http://www.dciscanning.co.za">www.dciscanning.co.za</a>
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### QUOTATION

DATE:	10 October 2011
COMPANY:	
PERSON:	
FROM:	CHRISTOPHER DARLINGTON
REFERENCE:	
TELEPHONE: CELLULAR	072 180 80 84
INTERNET EMAIL:	<a href="mailto:chris@dciscanning.co.za">chris@dciscanning.co.za</a>
GENERAL EMAIL:	<a href="mailto:sales@dciscanning.co.za">sales@dciscanning.co.za</a> <a href="mailto:support@dciscanning.co.za">support@dciscanning.co.za</a>

We take this opportunity to thank you for your valued interest in our products and/or services and for the opportunity to provide you with the following pricing for your perusal.

#### PRICING

	DESCRIPTION	QTY	UNIT PRICE	SELLING
	Redbeam Check In Check Out 1 User STANDARD	1	R 5782.40	R 5782.40
	Datalogic Heron USB	1	R 1280.00	R 1280.00
	Bixolon SLP T400 USB	1	R 3500.00	R 3500.00
	Syntex Label 1000 per roll 40 x 30	5	R 71.67	R 358.35
	Resin Ribbon	2	R 80.00	R 160.00
	Training & Installation	3	R 380.00	R 1140.00
	<b>TOTAL (excl. VAT)</b>			<b>R 12 220.75</b>
	<b>VAT@14%</b>			<b>R 1 710.90</b>
	<b>TOTAL (incl. VAT)</b>			<b>R 13 931.65</b>

#### CONDITIONS

1. Above prices are valid for 10 days from date of this document and exclude VAT.
2. Above prices are based on R7.9 = Dollar 1.00. Any fluctuations in foreign currency at time of invoice would be for your account.
3. Delivery is based on 2-4 days from date of official order, pending stock availability
4. DCI's terms of payment are C.O.D, unless an application for credit has been approved whereby 30 days net from date of invoice.
5. **BANK : FNB 50660087493 BRANCH 254205**

Should there be any further queries please do not hesitate to contact us.

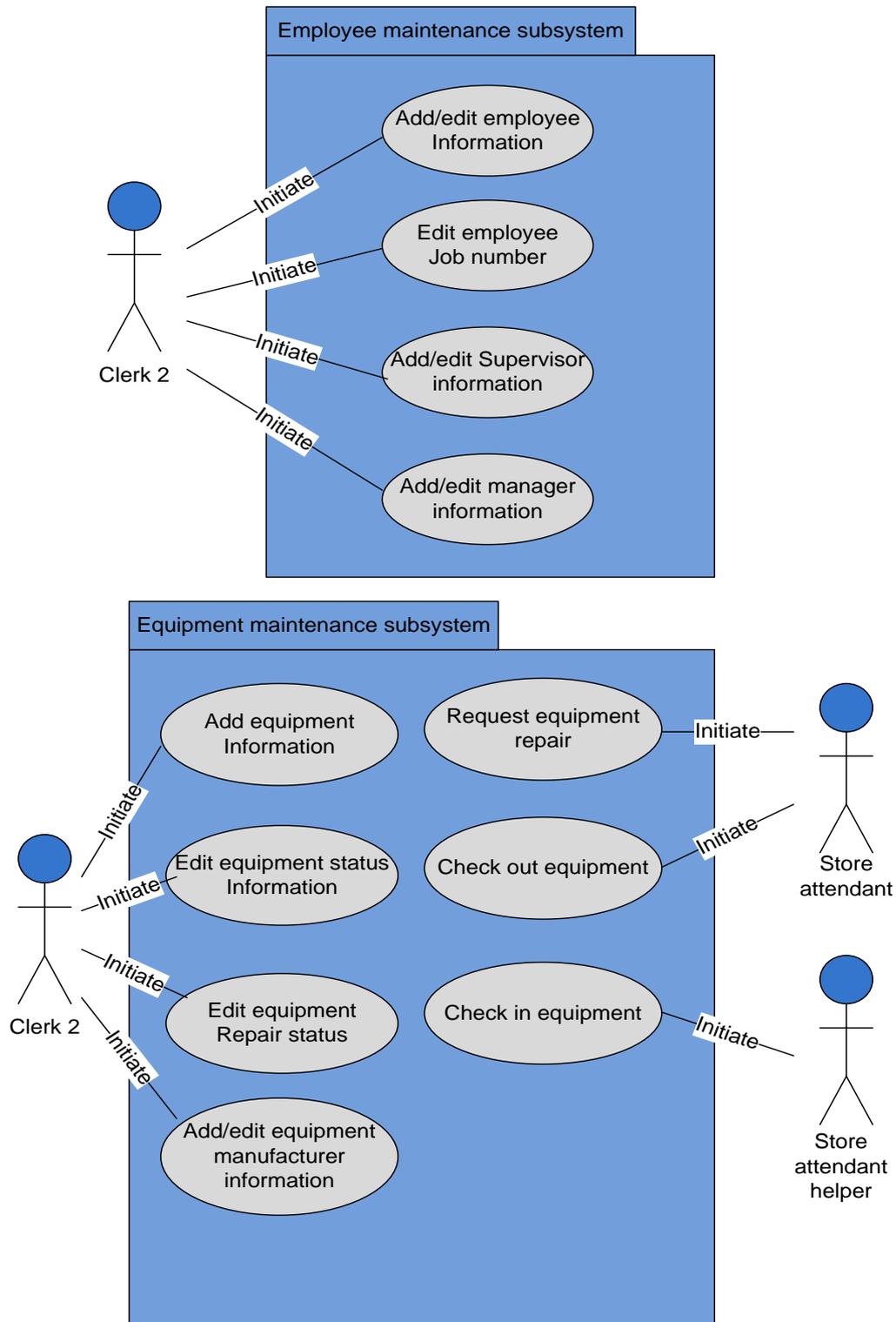
Yours sincerely

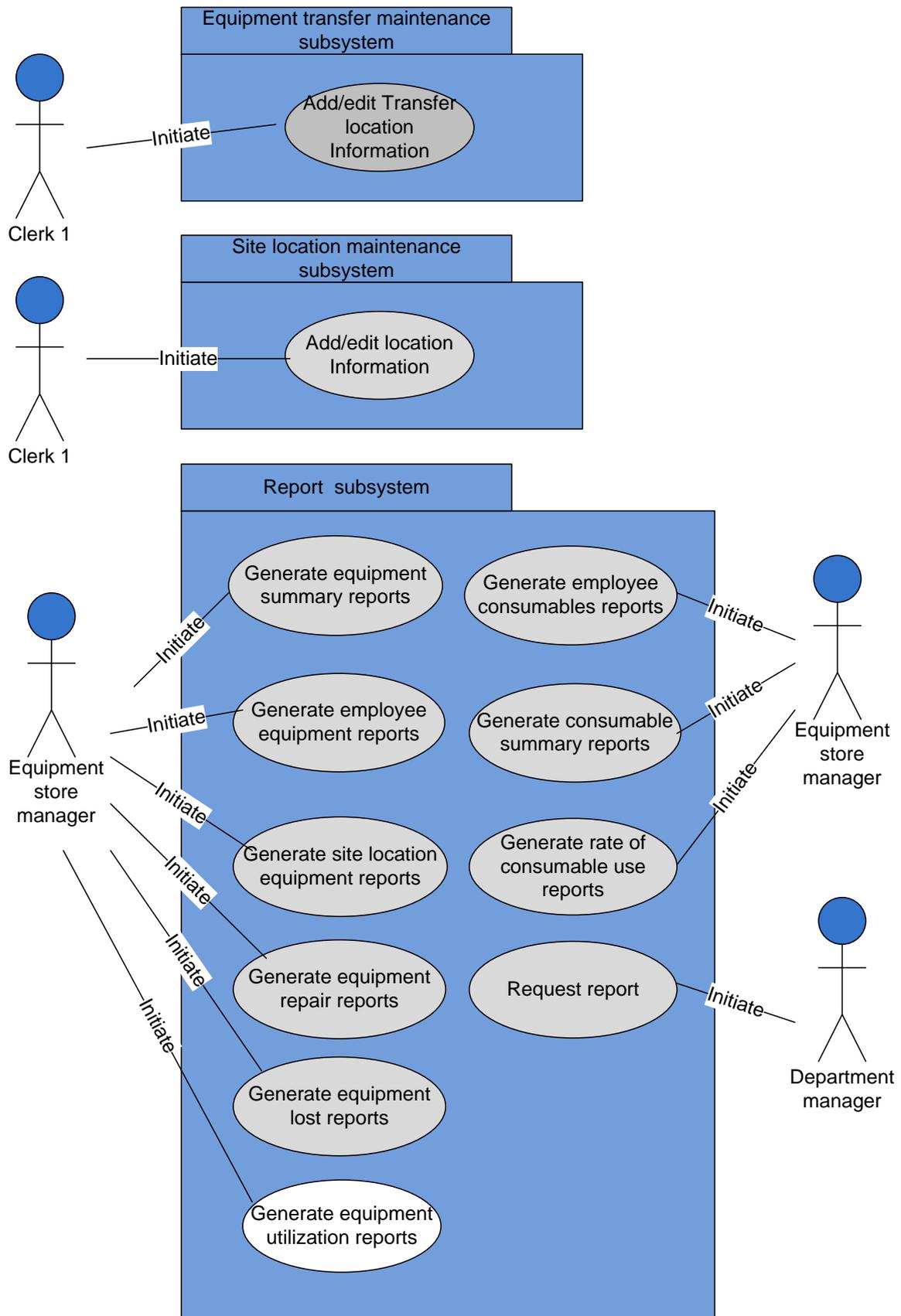
COMPANY CONFIDENTIAL

PAGE 1

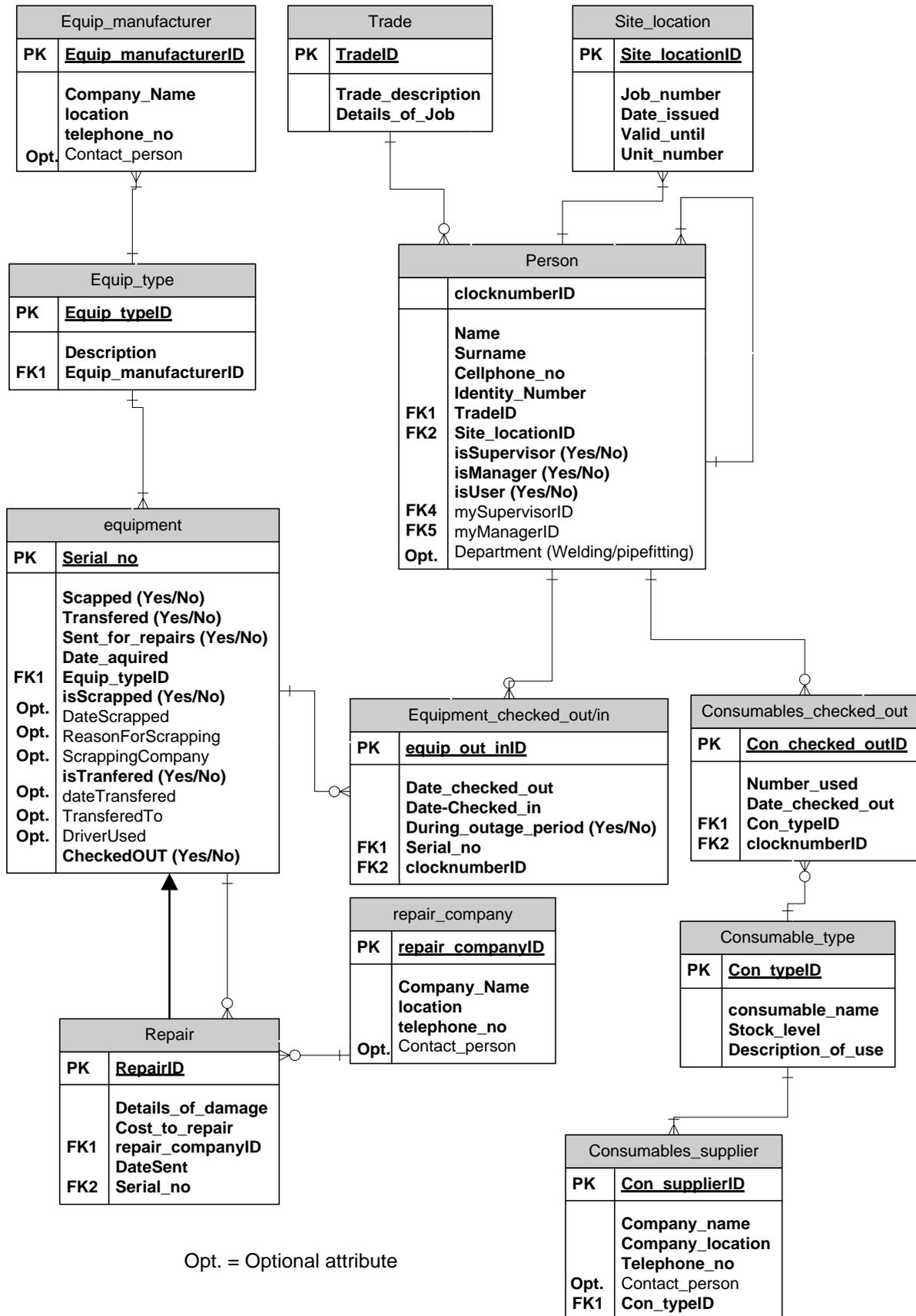


## Appendix B





## Appendix C

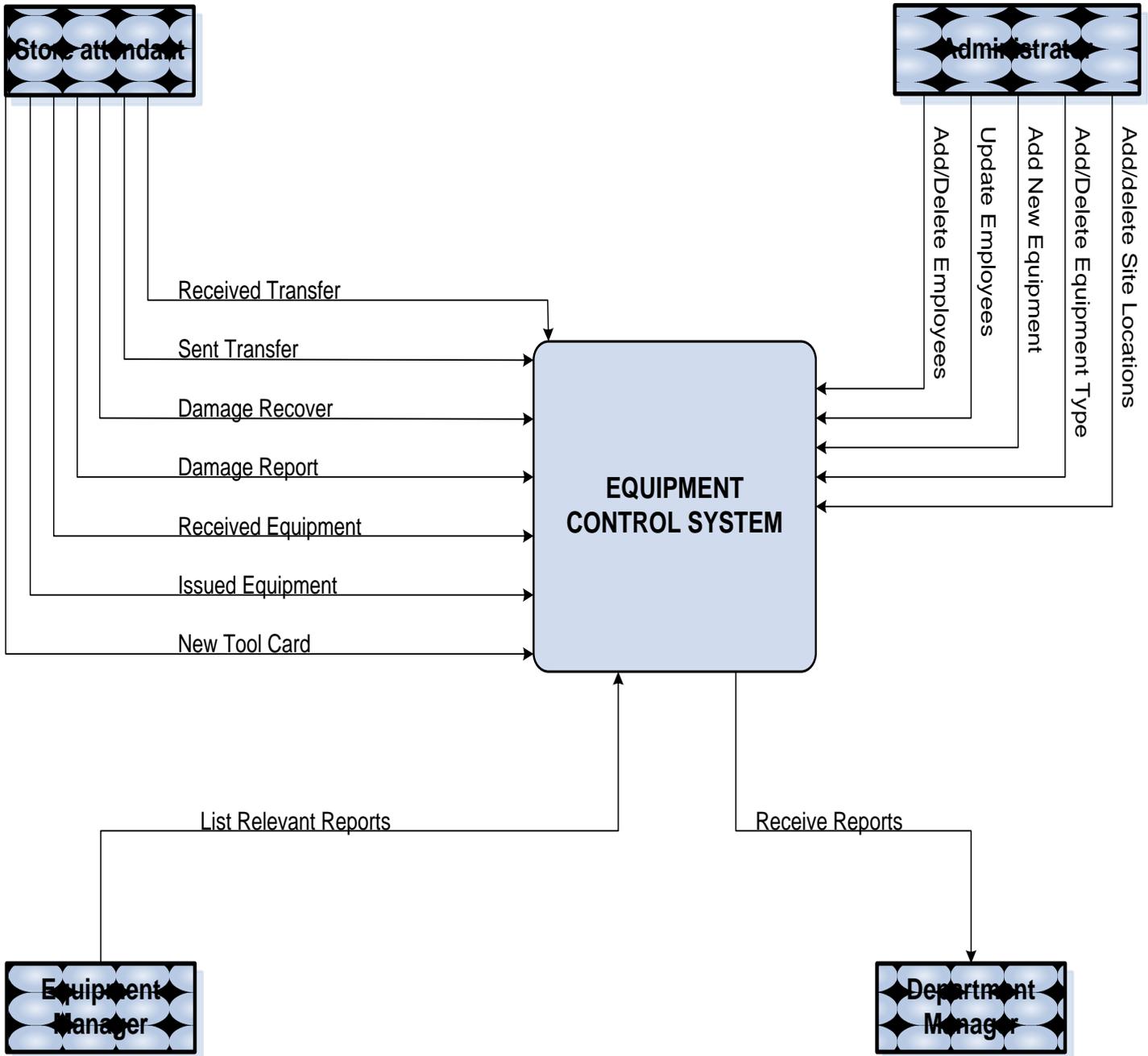


## Appendix D

Entity.attribute	Process employee addition to database	Process assigning site location to employee	process employee change of site location	Process employee change of trade	Process removing employee from database	process adding new equipment
person.clocknumber	C					
person.name	C					
person.surname	C					
person.cellphone_number	C					
person.isUser	C					
Person.isSupervisor	C					
Person.isManager	C					
Person.SupervisorID	R					
Person.ManagerID	R					
Person.Department	C					
person.tradeID	R					
person.site_locationID		R				
person.site_locationID			U			
person.tradeID				U		
person.clocknumber					D	
person.name					D	
person.surname					D	
person.cellphone_number					D	
person.position					D	
person.tradeID					D	
person.site_locationID					D	
person.site_locationID					D	
person.tradeID					D	
equipment.serial_number						C
equipment.equipment_typeID						C
equipment.dateacquired						C
equipment.checkedOUT						C
equipment.equip_typeID						R

Entity.attribute	Process scrapping equipment	process transferring equipment	process check out equipment	process check in equipment	Process adding new equipment type	process send equipment for repair	process adding new consumables	process check out consumables
equipment.isScrapped	C							
equipment.isTransferred	C							
equipment.isScrapped	U							
equipment.DateScrapped	C							
equipment.ReasonforScrapping	C							
equipment.ScrappingCompany	C							
equipment.isTransferred		U						
equipment.DateTransferred		C						
equipment.TransferredTo		C						
equipment_checked_out/in.datechecked_out			C					
equipment_checked_out/in.During_outage_period			C					
equipment_checked_out/in.serial_no			R					
equipment.checkedOUT			U					
equipment_checked_out/in.clocknumberID			R					
equipment_checked_out/in.datechecked_in				C				
equipment.checkedOUT				U				
equip_type.description					C			
equip_type.Equip_manufacturerID					R			
equipment.repairID						C		
repair.detail_of_damage						C		
repair.dateSent						C		
consumables.consumable_name							C	
consumables.stock_level							C	
consumables.description_of_use							C	
consumables_checked_out.number_used								C
consumables_checked_out.Date_checked_out								C
consumables_checked_out.Con_typeID								R
consumables_checked_out.ClocknumberID								R

# Appendix E



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