Relational Database Solution

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To support flight operations at VMGR-452, a number of support equipment is required ranging from fork lifts to test benches. Accountability of this gear is vital to ensure proper maintenance is done and that the Marine Corps is a good steward of US tax payer dollars. Currently, a list of gear is tracked by a Microsoft Excel document that is used by a number of users. This was fine when the number of items was small; however, it is now reaching over a thousand records. As a result, there are a number of inefficiencies that have been identified. By switching to a relational database solution, efficiency can be improved by reducing redundancy, improving data integrity, improving data security, and providing data manipulation to give meaning to the data.

Reduces Redundancy

Every quarter an inventory is conducted and the list is emailed to all the division officers, as well as copied to a network shared drive, which is utilized to plan operations and identify equipment that is a candidate for modification or upgrade. Having multiple copies leads to redundancy. In addition, redundancy also exists within the data. As see in Figure 1, the list shows 8 digital multimeters with fields such as PN and CAGE having repeating information.

	PN	Work Center	CAGE	Serial Number	Barcode	Subcus	Nomenenclature	NSN	StatusCd	tec	SMRCd	PrimeNIIN
1	915-15219	05D	99866	1064	0007257139	452	ACCESSORY SET, TORQUEMETER RUNOUT	3BD4920014876114DQ	A1	TBD	PAOOO	01-487-6114
2	IFR 6000	05D	51190	104005337	2774048129	452	IFR 6000 AVIONICS RAMP TEST SET	6RX6625015873942LC	A1	H7AA	PEOOK	01-587-3942
3	IFR 6000	05D	51190	14004426	2774048130	452	IFR 6000 AVIONICS RAMP TEST SET	6RX6625015873942LC	A1	H7AA	PEOOK	01-587-3942
4	8060A	690	89536	6515013	6300013541		4 1/2 DIGITAL VOLT METER	9FM6625011572246NU	A1	DHAA	PAGGD	01-509-8205
5	8840A/AA	670	89536	4172762	0007311006		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A2	DHAA	PEOGD	01-375-8765
6	8840A/AA	670	89536	4182766	0007311196		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A2	DHAA	PEOGD	01-375-8765
7	8840A/AA	610	89536	4187759	0007311005		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A5	DHAA	PEOGD	01-375-8765
8	8840A/AA	610	89536	4222756	0007311004		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A5	DHAA	PEOGD	01-375-8765
9	8840A/AA	610	89536	4222774	0007311003		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A5	DHAA	PEOGD	01-375-8765
0	8840A/AA	620	89536	4222785	7900013663		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A2	DHAA	PEOGD	01-375-8765
1	8840A/AA	670	89536	4222786	7700013690		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A1	DHAA	PEOGD	01-375-8765
2	8840A/AA	620	89536	A/AA4217779	0007311197		5 1/2 DIGIT DIGITAL MULTIMETER	7ZH6625012382000TE	A2	DHAA	PEOGD	01-375-8765
3	MAV-5	910	58501	FC1-10253-001	2774048141		A/C FUEL TANK RESPRIATORY PROTECTION SYS	3BD4920014943033LC	A1	SJAA	PAOOO	01-494-3033
4	MAV-5	910	58501	SM3-12042-001	2774048142		A/C FUEL TANK RESPRIATORY PROTECTION SYS	3BD4920014943033LC	A1	SJAA	PAOOO	01-494-3033
5	MAV-5	910	58501	SM3-12042-002	2774048143		A/C FUEL TANK RESPRIATORY PROTECTION SYS	3BD4920014943033LC	A1	SJAA	PAOOO	01-494-3033
6	MAV-5	910	58501	SM3-12042-003	2774048144		A/C FUEL TANK RESPRIATORY PROTECTION SYS	3BD4920014943033LC	A1	SJAA	PAOOO	01-494-3033
7	MAV-5	910	58501	SM3-12042-004	2774048145		A/C FUEL TANK RESPRIATORY PROTECTION SYS	3BD4920014943033LC	A1	SJAA	PAOOO	01-494-3033
8	MAV-5	910	58501	SM3-12042-005	2774048146		A/C FUEL TANK RESPRIATORY PROTECTION SYS	3BD4920014943033LC	A1	SJAA	PAOOO	01-494-3033

Figure 1. Sample Data showing Redundancy

In a relational database, multiple tables would be created to store redundant fields. As a new record is created only unique fields are added. For example, when a new digital mulitmeter

is added only the serial number, barcode, and subcust would be added to the database. A reference to the remaining fields would be used. This would free up storage space by creating the record only once which results in cost savings. A proposed model of the relational database can be seen in the Entity Relation Diagram (ERD) as seen in Figure 2.

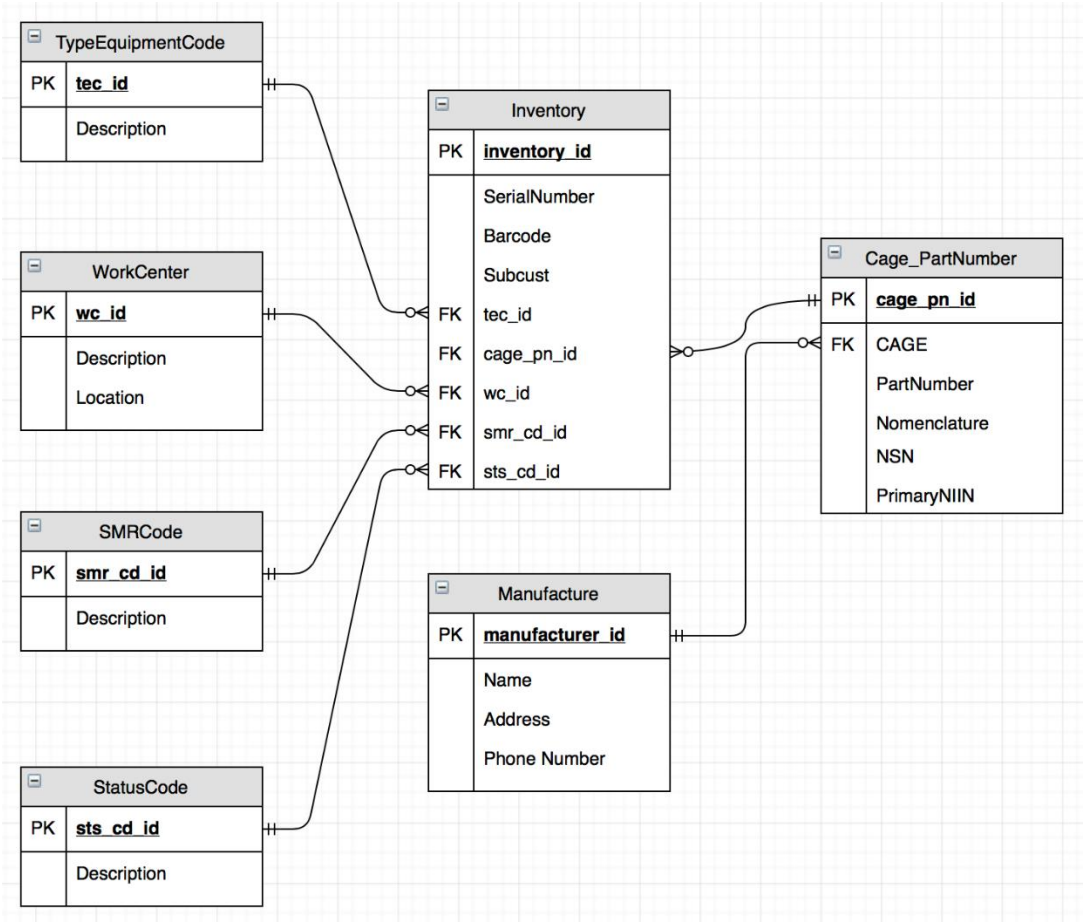

Figure 2. Support Equipment ERD

Improves Data Integrity

In addition to reducing wasted memory space, reducing redundancy also decreases the number of errors associated with having to update more than one record, or inconsistencies between the different lists that are distributed. For example, the “tec” field, which identifies the type of equipment, reveals that some fields were left blank or were identified with different

values such as the “TBD” (to be determined) or “NA” (not applicable) which are not valid values. With a relational database, data integrity rules and constraints are built into the database. Data types can be defined and validated before it is entered into the database by users using forms. In addition, there would be a centralized database so when changes are applied it will update all references to the data rather than having to find all occurrences manually and changing each record.

Improves Data Security

Currently there are no controls in place to prevent corruption or deletion of the data and this could come at a cost. According to IBM, the average cost of a data breach globally was $3.62 million in 2016 (Kerner, 2017). The file that is shared on the network is where updates are made. Although only Marines from the unit can access the file, not all Marines need access to the file. For example, a Private First Class (PFC) has very little experience with the data and can potentially corrupt or delete the data accidentally or maliciously. In a relational database, access controls are created to allow only authorized users, or multiple users, to access the data. The PFC would still be able to view or update some of the data but not all.

Provides Data Manipulation

Data analysis is critical to the success of any business and the key is being able to extract the data and produce reports in a meaningful way. Although excel documents can perform operations on the data using formulas, it is not scalable. As the list becomes larger, performance degrades. In a relational database, since data is related to each other it offers optimization through structured query languages (SQL) which can be 19 times faster than excel when executing 200 thousand lookups (AnalystCave, 2011).

Industry Standard

Many industries use relational databases manage their data. Facebook has over 2 billion active users and storing this in an excel file or flat file is not possible due to the memory and storage limitations which is why it has one of the largest relational database (DataCenterKnowledge, 2010). Amazon is one of the largest online retailers so security is paramount when storing credit card information. If all the customer information and order information was stored in one database, it would be impossible to hide credit card information from the people who fill the orders.

Conclusion

Data is a valuable resource and by keeping a list of support equipment in an excel spreadsheet is no longer acceptable. A relational database solution would reduce redundancy that free up storage space, reduces errors that results in inconsistent data, prevents unauthorized users from corrupting or deleting the data, and provides an optimized method for extracting the data that can be used for data analysis. Relational databases are widely used throughout many industries and has become the standard database model. As such, we need to modernize our database and switch to a relational database to meet our future needs.

References

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