Heavy Engineering

PROJECT REPORT

On

QRosity- Online Inventory & Asset Management With Mobile inventory Tracking

PREPARED BY-

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ACKNOWLEDGEMENT

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INTRODUCTION

About Larsen and Toubro HED

L&T's Heavy Engineering business custom-designs, fabricates and integrates engineered-to-order critical equipment and systems for core sector industries like fertiliser, refinery, petrochemical, chemical, oil & gas, thermal & nuclear power. It has a track record of executing large, complex projects. Its strengths include in-house design & engineering, state-of-the-art fabrication facilities, R&D centres, experienced project teams and a safe work culture. The business is structured into :

- Process Plant Equipment and;
- Nuclear

Process Plant & Nuclear Equipment

Operating at the upper end of the technology spectrum, this business manufactures and supplies custom-designed and engineered equipment and systems to critical process industries, viz., fertiliser, refinery, petrochemical, chemical, oil & gas, thermal and nuclear power. The track record covers large and complex projects that have set global benchmarks – including the world's largest ethylene oxide reactor, the biggest coke drum, etc. All the equipment is manufactured under stringent schedules and conform to high quality and safety standards.

Facilities-

1. Hazira Manufacturing Complex, Surat
2. Powai, Mumbai
3. Vadodara Heavy Engineering Works
4. Sohar, Oman

Statement of requirements:

1.Online System for Inventory and Asset Management

Current Scenario:
Perpetual inventory by F&A is totally manual- Perpetual Inventory check is an organizational audit compliance requirement. The more the inventory holding, as is typical in large manufacturing companies, the more the pain of verification. This is because the inventory is spread over multiple warehouses and locations.
Currently, the verification is a totally manual process. Moreover , multiple platforms need to be navigated for verifying and recoding the results of perpetual inventory check. For e.g. Erp has to be checked for taking the inventory data and then corresponding data has to be downloaded in excel so that it can be printed and then be carried to doing the perpetual inventory check. The data thereafter has to be reconciled and then uploaded again in Erp system.

Way Ahead:
Perpetual inventory by F&A is automated - Verification is automated using a portable software module developed to generate, decode and update information of a particular product . The information is encoded in a QR code and the module also supports excel integration which solves the problem of navigating through multiple platforms.

2.Simplifying high volume spool dispatches at L&T, Piping

Current Scenario:
Part verification post loading on vehicle and simultaneously creating an excel template for uploading data in ERP system directly is manual- Many wrong dispatches happen to customers due to high volume of spool consignments
and rectifying such mistakes is cumbersome.

Way Ahead:
Process of verification post loading is automated making it accurate- Using a portable software module ensures an accurate dispatch and information is uploaded in the ERP system then and there.

3.Product identification

Current Scenario:
Stencilling with paint on the spools done manually-Stencilling of the product information was done on spools. Later the same information was written into excel files manually. This was a tiresome process which increased the labour and error as human intervention was involved.

Way ahead:
QR codes containing product information are generated- Not only does this process time but helps in automation of collection of data.

PROJECT OVERVIEW

Functions

1. Automation of Perpetual Inventory Management process.
2. High Volume spool delivery verification at LTPC thru QR codes during dispatch with Excel report integration.

Software Requirements:

- Windows Operating System
- Camera Drivers
- SQL Server Support
- Microsoft Excel
- Visual Studio (.NET framework)

Hardware Requirements:

- Device running Windows OS(Tablet or desktop)
- Printer
- Supported Camera

Technologies used in Organisations for Product Material Tracking and Inventory Management

1. **Barcode-**A barcode, defined as "a machine readable form of information on a scan able visual surface," is a set of lines of varying widths and heights, and a sequence of letters and numbers. When scanned with a barcode scanner, the sequence is returned. Barcode isn't actually managed, but rather is used to manage a wide variety of products and processes. From retail products that are barcode labelled, scanned and transported via tracking barcode, to business processes that utilize barcodes to barcode label their assets, inventory and consumables. Barcode management is a unique asset

tracking and inventory maintenance tool. Barcode management is an invaluable tool – allowing materials and processes to flow smoothly, efficiently and in a most cost effective manner.

2. **QR Code-**Although barcodes are easy to use and inexpensive, they are very limited in the amount of information they can encode. In the last 10 years, new technologies have been developed that can encode much more and varied types of data. A QR code is a type of barcode that encodes information from left to right as well as up and down. Also known as a matrix barcode or a 2D barcode, the main difference between QR codes and barcodes is that QR codes can be encoded in two different directions at once- meaning they can hold more data, and they can also encode varied types of data, such as text, URLs, SMS messages, e-mails, or a virtual business card. QR codes are used most often in manufacturing inventory management for the tracking of vehicles and other products in the manufacturing process. Most consumers recognize QR codes from marketing efforts that ask them to use their smartphones to scan a QR code for extra information or a promotional code.

3. **RFID-** RFID, or Radio Frequency Identification, allows the reading and capture of information stored in tags via radio waves. The system consists of two parts- a tag or transponder and a reader- that pass signals to one another. Currently, RFID tags are used a wide variety of industries, ranging among mobile payment, healthcare, retail, amusement parks, casinos, Red box, gun control, and car rental. Most commonly seen RFID tags used in theft prevention in retail (cashiers must deactivate tags before you pass through the scanner by the entrance to the store). RFID tags are also used to track animals, to open security-locked doors, to pay freeway tolls electronically, and to track things like shipping containers, heavy machinery, trucks, and railroad cars. In addition to their versatility, RFID tags are helpful because the scanners can communicate with multiple tags at once and they don't need to be pointed directly at a tag or in a direct line

of sight in order to receive a signal. RFID tags are small and less invasive, yet they're also tough enough to withstand damage.

BARCODES vs. QR CODES vs. RFIDs

A Retail and Inventory Primer

Barcodes

Year Introduced
1974
The first item to have a barcode on its packaging was Wrigley's Gum.

Unique Advantages

Cheap and accurate. Systems usually pay for themselves within 6-18 months of installation. Despite predictions to the contrary, still very popular in retail and inventory.

Data Capacity
Up to 20 characters.

Speed
Relatively quick, though items need to be scanned individually.

Cost
$ $ $ $ $
Barcodes cost around 0.5c each, can be printed on standard printers, and readers are inexpensive.

QR Codes

Data Capacity
Up to 7,000 characters.

Cost
$ $ $ $ $
QR codes can be printed on practically anything and scanned on mobile devices, reducing startup costs. Faster systems are more expensive.

Year Introduced
Mid-1990s
Developed in Japan for use in the automotive industry.

Speed
On mobile devices, scanning can be quite slow, though reading is fast. Dedicated machines are faster.

Unique Advantages

Versatile – codes can include URLs, SMS messages, email messages and more. Can be linked to websites, apps and more. Can be printed on practically any surface.

RFIDs

Year Introduced
1973
Initially used as transponders for vehicle ID, security and banking. In 2003, WalMart announced all suppliers would be required to RFID tag items.

Unique Advantages

RFID chips can now be about the size of a grain of rice. Their significantly increased data capacity makes identifying specific items much easier.

Data Capacity
'Passive' (non-battery-powered) tags can store up to 4 million characters.

Speed
Scanners can communicate with multiple tags at the same time, without line-of-sight.

Cost
$ $ $ $ $
Tags cost an average of 15-30c, and systems are more expensive than for barcodes or QR codes.

SOURCES:

nationalbarcode.com/articles/what-is-a-barcode.html
nationalbarcode.com/articles/history.htm
barcoding.com/information/learn_about_barcodes.shtml
fcbco.com/blog/bid/314725/Pros-and-Cons-of-Bar-Code-Technology
qrcode.com/en/history
qrcode.com/en/about/
econsultancy.com/blog/7884-the-pros-and-cons-of-qr-codes
epc-rfid.info/rfid
technovelgy.com/ct/Technology-Article.asp?ArtNum=4
science.opposingviews.com/pros-cons-rfid-technology-17875.html
rfidjournal.com/articles/view?1338

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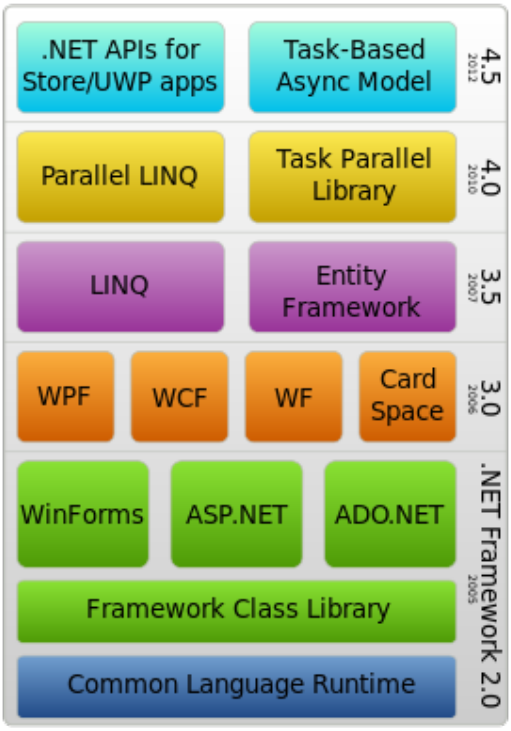
About .NET Framework

.NET Framework is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large class library named Framework Class Library (FCL) and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for .NET Framework execute in a software environment (in contrast to a hardware environment) named Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management, and exception handling. (As such, computer code written using .NET Framework is called "managed code".) FCL and CLR together constitute .NET Framework.

FCL provides user interface, data access, database connectivity, cryptography, web application development, numeric algorithms, and network communications. Programmers produce software by combining their source code with .NET Framework and other libraries. The framework is intended to be used by most new applications created for the Windows platform. Microsoft also produces an integrated development environment largely for .NET software called Visual Studio.



PROJECT IMPLEMENTATION

Camera Integration

Using AForge.NET which is an open source C# framework designed for developers and researchers in the fields of Computer Vision and Artificial Intelligence - image processing, neural networks, genetic algorithms, fuzzy logic, machine learning, robotics, etc. , the camera device has been integrated with the developed software.

Delegates, Classes and Namespaces Used-

`using AForge.Controls –` The AForge.Controls namespace contains different useful UI controls, which may be used together with other classes of AForge.NET framework.

- PictuereBox- Control for displaying an image.

`using AForge.Video–` The AForge.Video namespace contains interfaces and classes to access different video sources.

- NewFrameEventHandler- Delegate for new frame event handler.

`using AForge.Math–` The AForge.Math namespace contains set of math utilities, which are used by other AForge.NET framework's namespaces or may be used individually.

`using AForge.Video.DirectShow–` contains classes, which allow to access video sources using DirectShow interface.

- FilterInfoCollection- Collection of filters' information objects.
- VideoCaptureDevice- Video source for local video capture device.

ZXing Library

A library which supports decoding and generating of barcodes (like QR Code, PDF 417, EAN, UPC, Aztec, Data Matrix, Coda bar) within images.

Classes and Namespaces Used-

using ZXing-

- Result- Encapsulates the result of decoding a barcode within an image.
- Writer(Interface)- The base class for all objects which encode/ generate a barcode image.

using ZXing.Common-

- BitArray- A simple, fast array of bits, represented compactly by an array of ints internally.
- BitMatrix- Represents a 2D matrix of bits.

using ZXing.QrCode-

- QrCodeEncodingOptions- Holds available options for the Barcode Writer.

Database Communication

Using Sql Database on local server, WinForm communicated with database to store, retrieve and update information using-

```
using System.Data.SqlClient;
```

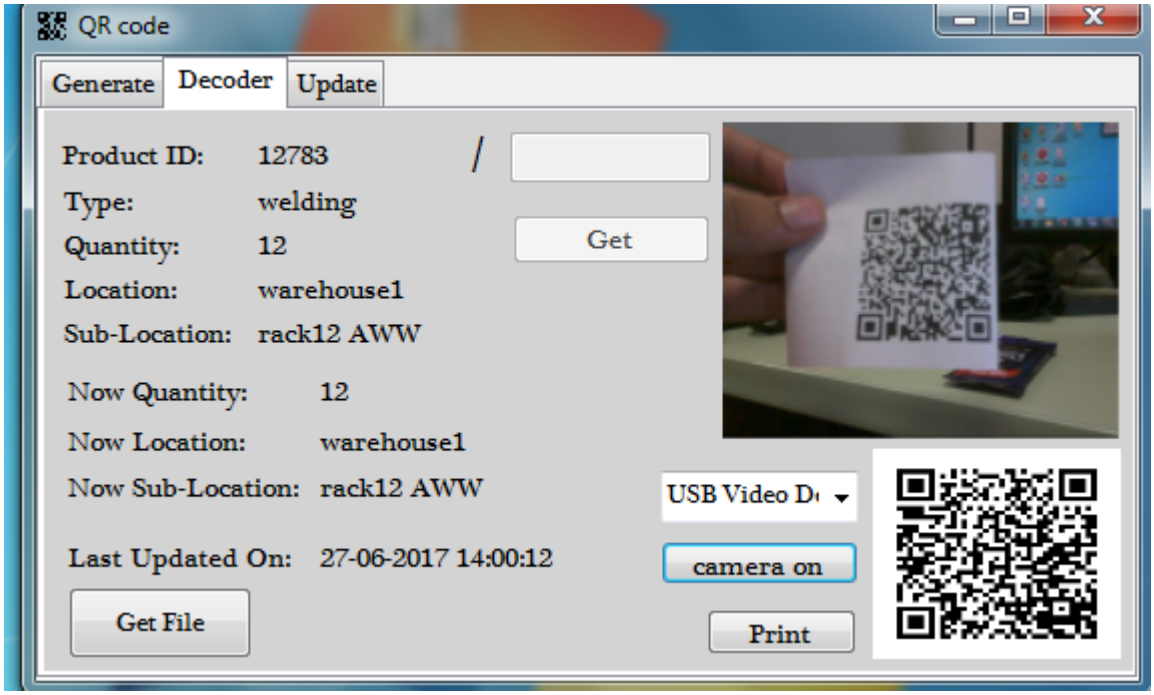
The System.Data.SqlClient namespace is the.NET Framework Data Provider for SQL Server.

- SqlCommand- Represents a Transact-SQL statement or stored procedure to execute against a SQL Server database. This class cannot be inherited.
- SqlConnection- Represents an open connection to a SQL Server database. This class cannot be inherited.
- SqlException- The exception that is thrown when SQL Server returns a warning or error. This class cannot be inherited.

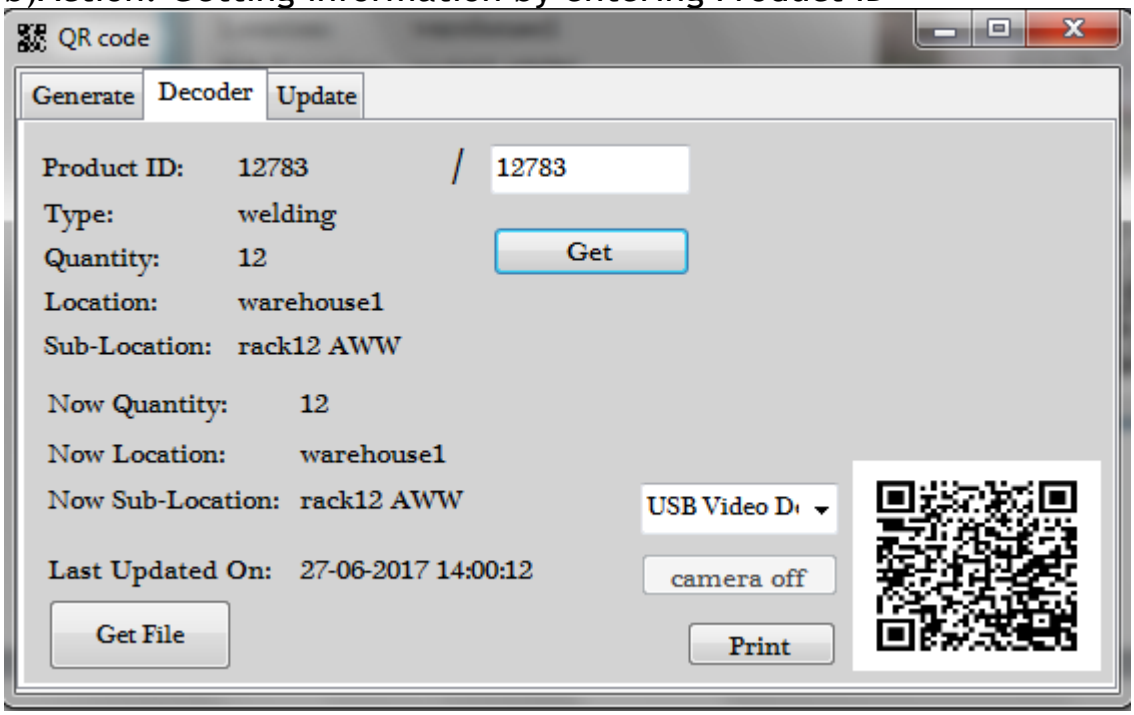
Screenshots of Workflow

STEP 1-
Feature: Replaces the existing method of stencilling which takes time
Action: Generating QR Code for specific product

STEP 2-
Feature: Automation of collection of data
a)Action: Getting information by scanning QR Code



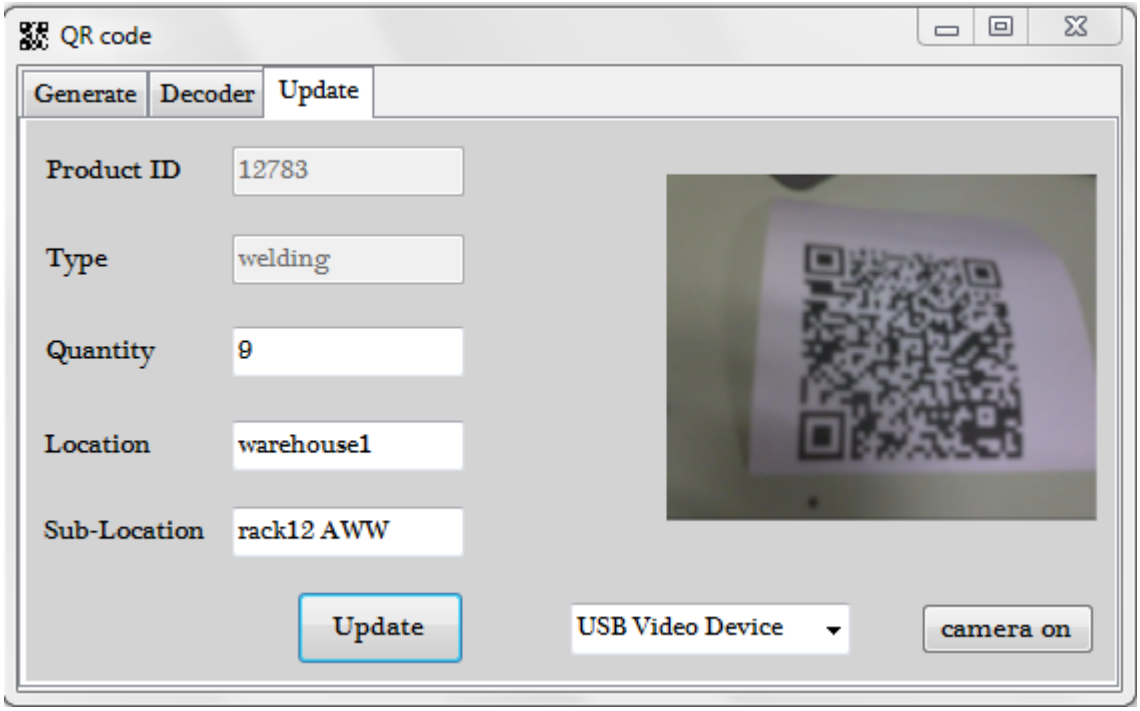
b)Action: Getting information by entering Product ID



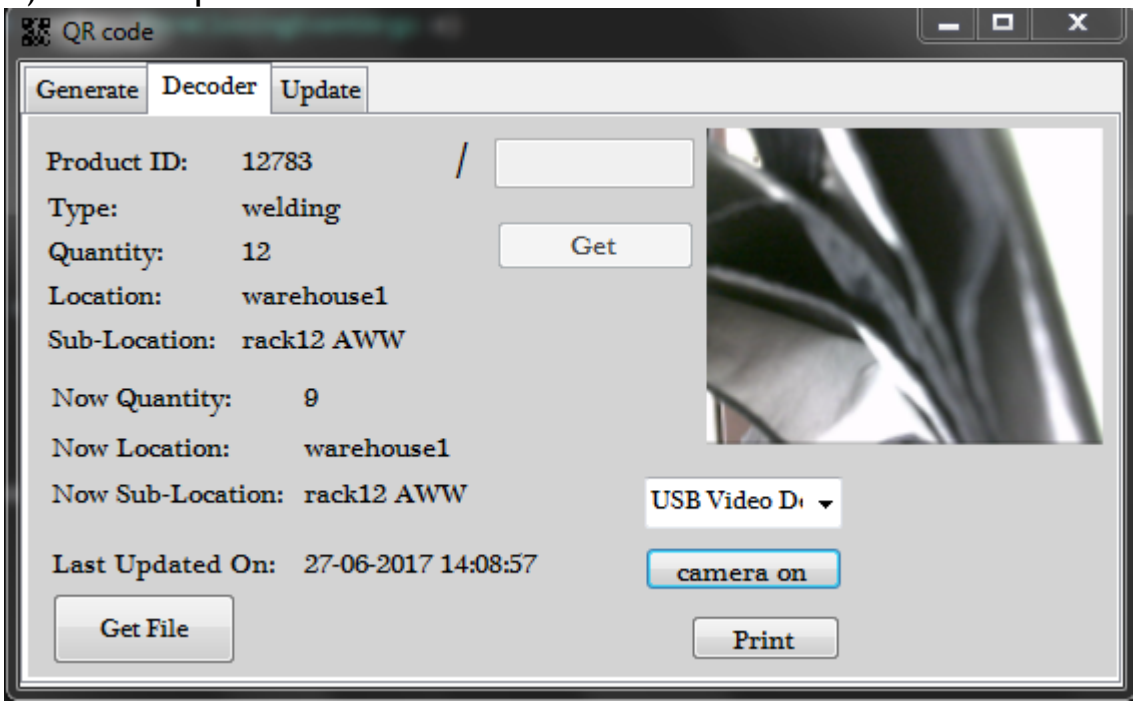
STEP 3-

Feature: Automates the Perpetual inventory management

a)Action: Updating Quantity from 12 to 9



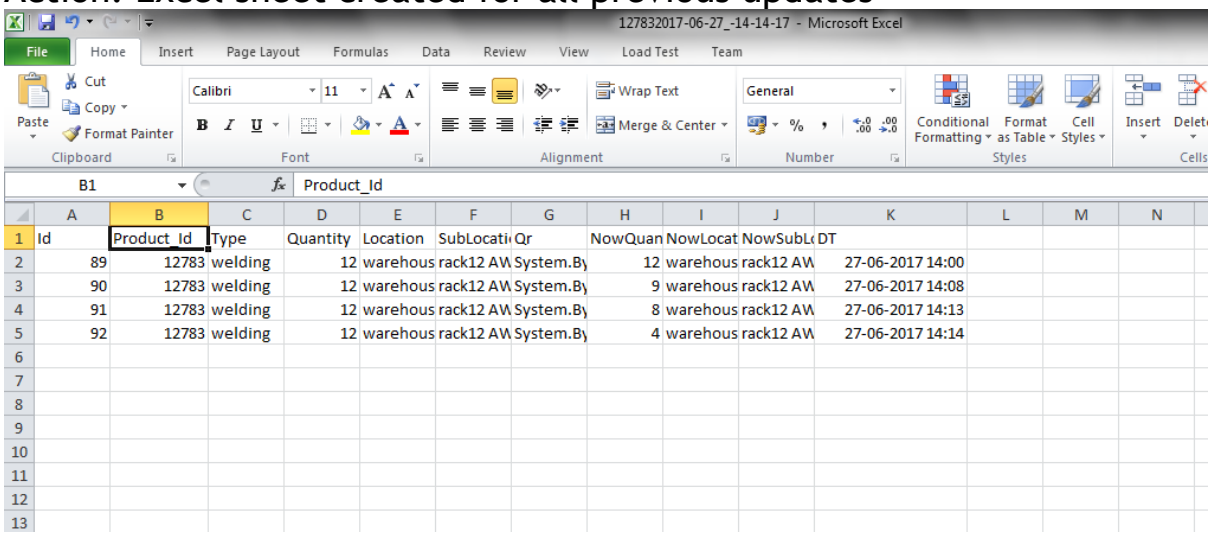
b)Action: Updated information



STEP 4-

Feature: Excel sheet integration for inventory check and part verification

Action: Excel sheet created for all previous updates



127832017-06-27_-14-14-17 - Microsoft Excel

File | Home | Insert | Page Layout | Formulas | Data | Review | View | Load Test | Team

Cut, Copy, Format Painter, Paste — Clipboard
Calibri, 11 — Font
Wrap Text, Merge & Center — Alignment
General — Number
Conditional Formatting, Format as Table, Cell Styles — Styles
Insert, Delete — Cells

B1 | Product_Id

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Id	Product_Id	Type	Quantity	Location	SubLocati	Qr	NowQuan	NowLocat	NowSubL	DT			
2	89	12783	welding	12	warehous	rack12 AW	System.By	12	warehous	rack12 AW	27-06-2017 14:00			
3	90	12783	welding	12	warehous	rack12 AW	System.By	9	warehous	rack12 AW	27-06-2017 14:08			
4	91	12783	welding	12	warehous	rack12 AW	System.By	8	warehous	rack12 AW	27-06-2017 14:13			
5	92	12783	welding	12	warehous	rack12 AW	System.By	4	warehous	rack12 AW	27-06-2017 14:14			
6														
7														
8														
9														
10														
11														
12														
13														

RESULTS

The proposed system developed serves the following purposes-

- Automates the process of inventory management and collection of data.
- Reduces the time taken for stencilling and provides important information in the QR code instead.
- The organisations' requirement of product tracking has been fulfilled.
- The introduction of QR codes in warehouses and other storage locations reduces labour and human effort. Important information regarding the product is encrypted in the QR code and when scanned with the proposed system, displays all the related information for the user.
- Reduces the number of errors during spool dispatches and makes the process of part verification post loading easier.

SUMMARY

The exponential growth of technology and digitisation, and the way it has dramatically disrupted our lives is without precedent. As digitisation of process and content accelerates, intelligent automation significantly reduces the labour component in organisations, perhaps making it redundant in many cases. And this in turn frees up time.

This may include automating manual processes in the process flow, development of software modules that aid workers to get allocated work done faster and automation of processing of data.

The following project provides all the above stated functions and supports the work staff and managers for managing inventory perpetually and aids the organisation in reducing the number of errors while dispatching spools.

Lastly, extensions to this project can be made in the future which includes portability to other operating systems, enhancing the camera device used by adding flash and auto focus, reducing the size of QR code according to the specified requirements.

CONCLUDING REMARKS

The following project has provided me with first-hand experience with Visual Studio and has given me knowledge about the various classes and their corresponding functions. It has helped me with importing external libraries and using them to interface hardware with software for e.g. integrating a camera device, using a printer to print QR codes. Also, it enabled me to understand the concept of events in programming and has given me a chance to make my own interface.

Additionally, during my tenure in the organisation I gained in depth knowledge about a product's flow and the various processes related to managing products in warehouses and locating them in various locations.

The project required me to equip myself with information about the latest technologies used in organisations for product material tracking and inventory management.

Lastly the programming phase helped me to strengthen my C# concepts.