

Review Paper on Industrial Automation based on OpenCV

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Abstract: As the name Industrial Automation based on OpenCV suggests that some kind of control in instruments/industrial machines is being done. OpenCV(Open Computer Vision) is the image processing library. We can write programs in any IDEs(Integrated Development Environments) in C/C++ language installing OpenCV library in it. Based on that image processing results we can control or automate industrial machines or any process in industries. We can choose any sequences for that.

Keywords: Automation, IDE, Image Processing, Linux, OpenCV

I.INTRODUCTION

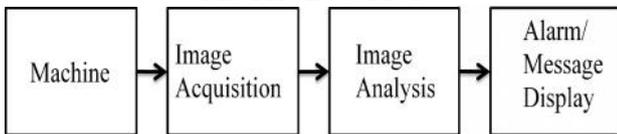


Fig.1. Simple Block Diagram

Here is the simple block diagram. First block shows any machine of industry. I have shown some industrial examples below. For data acquisition we can use any type of camera but for real time application USB webcam is the best where very high resolution is not much concern. For Image Analysis I have used Qt Creator IDE in Linux Ubuntu. After that we can install and include OpenCV library in Qt Creator. As a part of controlling action we can display message/ make alarm on for different kind of sequences. Then one can take actions manually. Another possibility is, halt in process by connecting hardware with Qt Creator. If we use Qt Creator in Windows Operating System, we can use proximity switch& PLC, and can give signal to stop machine in case of error. Block diagram of it given below.

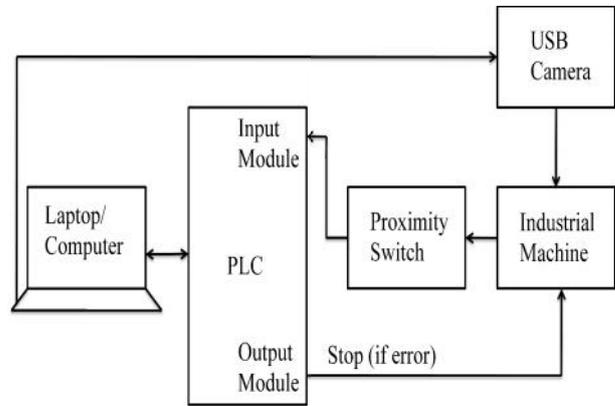


Fig.2. Block Diagram to implement in Windows O.S.

II.AUTOMATION

Automation involves the monitoring of inputs and providing of outputs using the brain for processing the inputs and making the decision in achieving what is needed as an output. Automation gives more productivity, safety, improved plant performance.

III.IMAGE PROCESSING

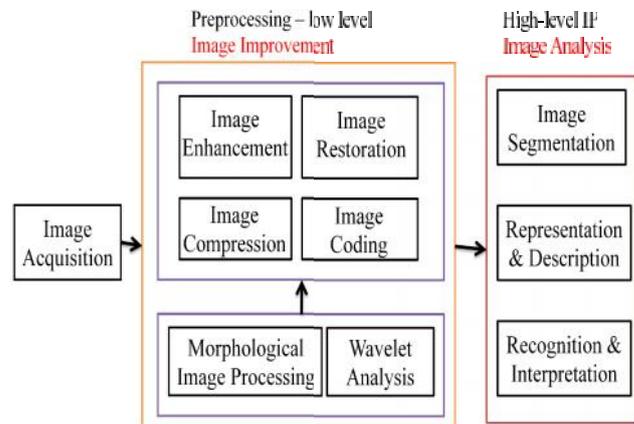


Fig.3. Image Processing Understanding

IV.EMBEDDED/ MACHINE VISION

Embedded Vision refers to machines that understand their environment through visual means. Embedded vision is the merging of two technologies: embedded systems and computer vision (also sometimes referred to as machine vision). Computer vision is the use of digital processing and intelligent algorithms to interpret meaning from images or video. Computer vision has mainly been a field of academic research over the past several decades.

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V.OPENCV

OpenCV is an open source computer vision library developed in C and C++. It is optimized and intended for real-time applications. It is independent of platforms and hardware, allows for generic loading, saving and acquisition of images and videos, and provides both low and high level APIs (Application Programming Interfaces).

VII.LINUX

Linux was originally developed as a free operating system for Intel x86-based personal computers. It has since been ported to more computer hardware platforms than any other operating system. It is a leading operating system on servers and other big iron systems such as mainframe computers and supercomputers: more than 90% of today's 500 fastest supercomputers run some variant of Linux. Linux also runs on embedded systems such as mobile phones, tablet computers, network routers, televisions and video game consoles; the Android system in wide use on mobile devices is built on the Linux kernel.

VIII.UBUNTU

Ubuntu is a computer operating system based on the Debian Linux distribution and distributed as free and open source software, using its own desktop environment. As of 2012, according to online surveys, Ubuntu is the most popular Linux distribution on desktop/laptop personal computers, and most Ubuntu coverage focuses on its use in that market. However, it is also popular on servers and for cloud computing.

VIII.QT

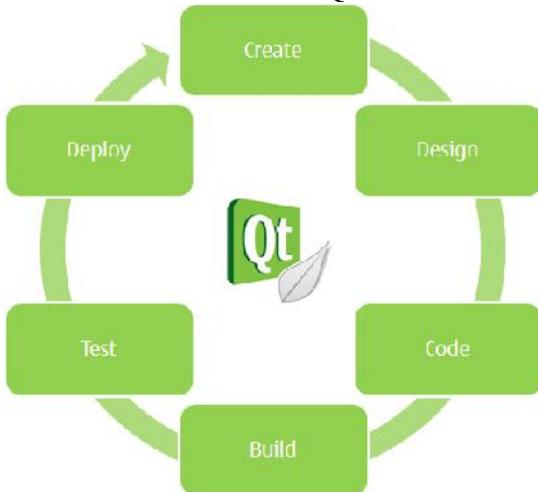


Fig.4. Qt Cycle

Qt is a framework to create cross-platform applications. Using Qt one can create amazing GUI applications quickly and easily. Visual Studio and X code is used to create applications in Windows and Mac respectively. Qt is similar to these tools in that it helps you to design and code your application. But, the real advantage of Qt is that that your application can be made to run on Windows, Mac and Linux without you having to change your code.

Qt Creator is the main IDE (Integrated Development Environment).



Fig.5. Qt Creator

Qt Designer is used to design the User Interfaces of your application. Even the Designer is integrated into Qt Creator.

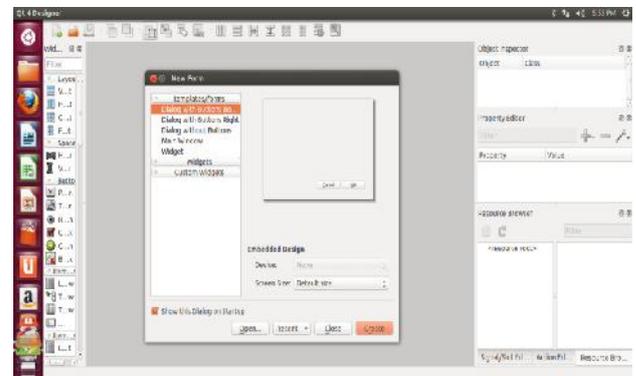


Fig.6. Qt Designer

Qt Linguist is a tool for aiding the translation of your application into various languages.

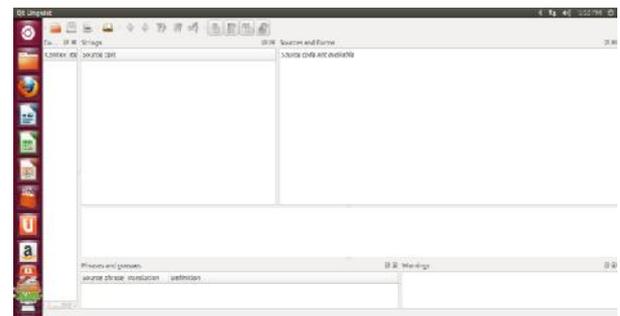


Fig.7. Qt Linguist

Qt Assistant is used for viewing the help files and documentation related to Qt.

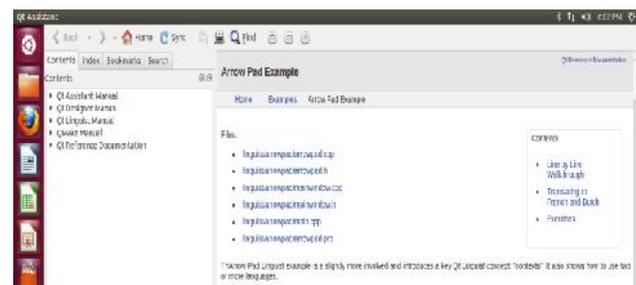


Fig.8. Qt Assistant

Using if conditions we can display message or

play sound if error occurred.

For sound we can use:

Qsound :: play(“file location.wav”);

Before that we need to install and add various libraries regarding sound in Qt Creator.

IX.EXAMPLES

a. CNC lathe auto loader

Here we can continuously detect object and can say if object is present or absent.



Fig.9. CNC lathe with auto loader

b. CNC router



Fig.10. CNC Router

We can show edges of work piece and calculate angle in accordance with x, y positions.

c. Plastic Injection Molding Machine

Monitoring of pieces in molding machine can be done by continuous tracking.



Fig.11 (a). Plastic Injection molding machine open with pieces



Fig.11 (b). Plastic Injection molding machine open with pieces eject in clamp unit



Fig.11 (c). Plastic Injection molding machine closed

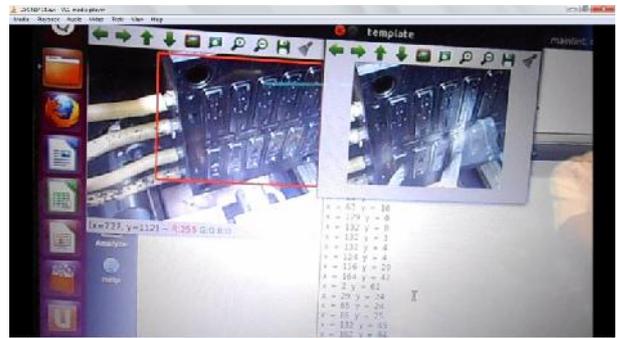


Fig.12 (a). Another Plastic Injection molding machine open with pieces showing reference and template



Fig.12 (b). Plastic Injection molding machine open with pieces showing result

X.CONCLUSION

These are only examples. Image Processing is very vast so we can use it on multiple machines and in multiple ways. I have opted Linux Operating System, Qt Creator, OpenCV even though other software like MATLAB, LabView are available, as software cost matters. Implementing Embedded Vision is challenging as there is limited experience in building practical solutions. Generally image processing based companies are from

abroad, if we are successful in such kind of applications, it will be more beneficial. This is futuristic technique. It will going to be deployed much, like the way wireless technologies are now taking place.

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