Online Blade Print Monitoring System

Navneet Kaur
Students, Department of Electronics and Communication Engineering,
Rayat Bahra Institute of Engineering and Nano-Technology, Hoshiarpur,Punjab, India.

Kritika Mehta
Students, Department of Electronics and Communication Engineering,
Rayat Bahra Institute of Engineering and Nano-Technology, Hoshiarpur,Punjab, India.

Divyanshu Joshi
Students, Department of Electronics and Communication Engineering,
Rayat Bahra Institute of Engineering and Nano-Technology, Hoshiarpur,Punjab, India.

Hemant Kumar
Students, Department of Electronics and Communication Engineering,
Rayat Bahra Institute of Engineering and Nano-Technology, Hoshiarpur,Punjab, India.

Manoj Pathania
Students, Department of Electronics and Communication Engineering,
Rayat Bahra Institute of Engineering and Nano-Technology, Hoshiarpur,Punjab, India.

Rakesh Sharma
Engineers, Department of Electrical Engineering,
Tigaksha Metallics Pvt. Ltd. Gagret, Himachal Pradesh, India.

Anil Kumar
Engineers, Department of Electrical Engineering,
Tigaksha Metallics Pvt. Ltd. Gagret, Himachal Pradesh, India.

Abstract- Online Blade Print Monitoring system is used for monitoring the blades when a large number of blades in the form of strip are rotating on a wheel. We use Raspberry Pi module B 3 with camera module to take pictures of the blades and then compare those pictures with pictures which are taken as reference pictures. Using haar cascade feature of OpenCV, we can compare pictures. Haar-cascade feature includes comparison of brightness of the sample pictures taken. In this way we can remove the requirement of a person to inspect each blade of strip individually.

Keywords – Raspberry Pi, HDMI, OpenCV, Camera, Blade

I. INTRODUCTION

Now a day, the industrial works are developing in such a pace that the projects installed in the industries with advanced features and technologies with integrated chips and module. The online blade monitoring system is the project that automates the blade print monitoring by using raspberry pi module. This online blade print monitoring system basically reduces the human need to be on the monitoring system on blade. The Raspberry pi module with camera module interconnected with it is used to take the pictures of the prints on the blades and inspect the blades print rather they are correctly printed on the blade or else, they are overflowed with the ink or the print are lighter on the blade. All such inspection are performed with the help of online blade print monitoring system.

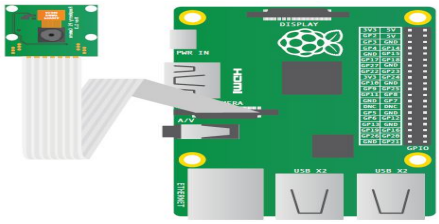

Fig.1 Raspberry Pi 3 Module B with camera

II. BLADE PRINT MONITORING SYSTEM

Initially the blades printing was monitored using the stroboscope for lowering the speed of the rotating strip of blades on the wheels of the machine during the printing mechanism. The stroboscope offers an easiest method for measuring frequency of rotation of a mechanical system. In order to complete this task, mark a convenient point on the rotating device. And then beginning with a flash rate which is clearly higher than the frequency of the rotating device, and adjusting the flash rate until the mark on the device appears stationary.

This mechanism was used and till now is used by many blade companies in order to measure the print of the company name on the blades. The disadvantage of using the stroboscope is that by lowering the speed to make the visibility of the blade prints feasible for the operator employed to see with naked eye over here, the operator must be employed over here 24x7 so that the quality of printing could be managed.

Fig.2 Blade Monitoring with Stroboscope

III. COMPONENTS AND DEVICES USED IN THE INTERCONNECTION OF RASPBERRY PI

3.1 SD – Card

The minimum size of SD- Card that can be used for Raspberry pi is of 4 gigabits of class 4(which signifies the fastness of it).

3.2 Keyboard and Mouse

Any USB keyboard and mouse can be used for the connections. These devices usually take a lot of power from the USB port, and may use powered USB hub which may also include some wireless devices.

3.3 HDMI to HDMI/ DVI Lead

HDMI to HDMI lead is used to connect the monitor to the Raspberry pi module. We can also use the HDMI to DVI lead in which there is a DVI input for the monitor which is needed for the interconnections.

Fig.3 HDMI Connector

Fig.4 HDMI to DVI Lead

Fig.5 RCA video Lead

3.4 Ethernet Cable

Ethernet cable is used to connect the internet connections to the Raspberry pi module otherwise we can also use the Wi-Fi router to connect wirelessly. This networking is optional and is essential in order to update and get new software for the Raspberry pi module.

3.5 RCA Video Lead

A standard video lead is required to connect the analogue display in case we are not using HDMI output.

3.6 Power Adapter

A good quality USB power supply needed for the module at least 700miliampere at 5volt is necessary. We may also use the mobile phone charger for this purpose.

3.7 Camera Module

The Raspberry pi camera module is used in the project. This camera includes Sony IMX219 8-Megapixel sensor. We can also use this camera in order to take the high definition videos as well as photographs.

Fig.6 Raspberry Pi Camera Module v2

IV. SPECIFICATIONS OF RASPBERRY PI 3 MODULE B

4.1 System on Chip (SoC)

The Raspberry Pi 3 Module B consists of a system on chip named Broadcom BCM2837. It has high performance ARM Cortex-A53 processing cores.

Fig.7 SoC

4.2 CPU

CPU stands for Central Processing Unit. It includes 4xARM Cortex-A53 with 1.2 GHZ processor that has running speed at 1.2GHz having 32kB Level 1 and 512kB Level 2 cache memory to do all the tasks with ARM architecture in Linux based operating system.

4.3 GPU

GPU stands for Graphical Processing Unit. This is used in the Pi module and is called as Broadcom VideoCore IV which is linked to a 1GB LPDDR2 memory module on the rear side of the board.

4.4 RAM

RAM stands for Random Access Memory. Raspberry Pi 3 module B contains 1GB LPDDR2 (Low Power Data Rate Memory) which is having 900 MHz speed. It is also called as Mobile DDR (MDDR). Various features of LDDR2 are as follows:

1. Density upto 8 Gb
2. Maximum clock speed-333 MHz
3. Data width - 16&32 Bits.

4.5 Networking

The networking is done with 10/100 Ethernet, 2.4GHz and along with 802.11n wireless connection.

V. RASPBERRY PI MODULE PARTS DESCRIPTION

The Raspberry pi module is the single board computer. We are using Raspberry Pi3 module B which is the third and latest generation of Raspberry Pi. It has a more powerful processor, which is 10 times faster them as compare to is 1st generation of Raspberry Pi. It includes system on chip that integrates the various major functional elements into a one chip. The module is having a programmable processor in on chip memory.

5.1 GPIO

The Raspberry Pi 3 has total 40 pins. The general purpose input-output works without modifications. The changes are usually made only on the switch to which UART which is exposed on the GPIO pins, but actually this is handled internally by the operating system.

Fig.8 USB Ports

Fig.9 GPIO Pins

5.2 Bluetooth

Bluetooth used in the Raspberry Pi 3 module is Bluetooth 4.1 Classic. It is having very energy utilization.

5.3 Storage

The micro SD card is used to store images or videos taken by the camera module.

5.4 USB Ports

The Raspberry Pi has 4 USB ports in order to connect different devices like keyboard, mouse, Wi-Fi, Dongles, USB sticks containing that contains all the files. But these ports don't provide much power, so we can use a USB port to the Pi that comes with external power supply.

5.5 Antenna

The Raspberry Pi 3 module doesn't need any connection of an external antenna. The antenna is on chip board with connections soldered on the chip in order to make the size of device compact.

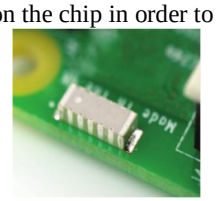

Fig.10 Module Antenna

Fig.11 USB chip

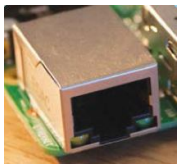

Fig.12 Ethernet Port

5.6 USB CHIP

The module makes use of SMS LAN9514 chip as its pre-predecessor, adding 10/100 Ethernet connectivity and four USB channels to the board. The SMSC chip connects to the System on Chip(SoC) through single USB channel, acting as a USB-to-Ethernet adapter and USB hub.

5.7 Ethernet Port

In order to connect the internet connection, a wire named Ethernet cable is used. The Raspberry Pi module is directing connected to the internet through Ethernet port connected to it.

5.8 Audio Out

Audio out is used like a headphone socket. It allows to connect to computer speaker.

Fig.13 Audio out

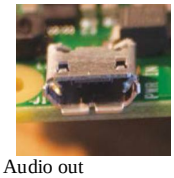

Fig.14 Power port

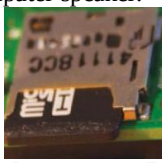

Fig.15 microSD slot

5.9 POWER

This is the pin point in the Raspberry Pi module to connect it to the power through the charger.

5.10 Micro SD Card Slot

A little SD card is used as the Raspberry Pi hard drive.

5.11 HDMI Port

The HDMI port is used to connect to the monitor. The slot present on the module is as follows

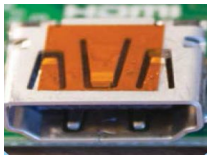

Fig.16 HDMI port

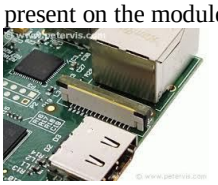

Fig. 17 CSI camera port

5.12 CSI Camera Port

CSI camera port is used for connecting the Raspberry Pi camera. This is a camera port providing an electrical bus connection between the two devices. It is a very simple interface. The Raspberry Pi has a camera interface (ZIF 15) where a ribbon cable connects to establish the communication bus. The CSI connector consists of two smaller interfaces. The first interface is for the transfer of data and clock signals from the camera to the processor in one direction only. The second interface consists of SCL/SDA lines, which is bidirectional link.

BLOCK DIAGRAM

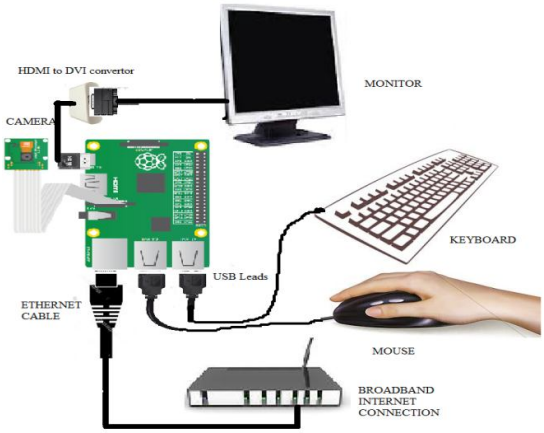

Fig.18 Block Diagram of Online Blade Print Monitoring System

The block diagram of the online blade print monitoring system involves the interconnection of the monitor, mouse, keyboard to the module through the various leads such as USB cables, HDMI to DVI convertor leads, Ethernet cable etc. The camera module is also connected to the module in the slot provided to be interconnected.

VII. WORKING

The working of the online blade print monitoring system basically involves image processing that is done with the help of python language in the Raspberry Pi module. Firstly the blade picture is taken by the module which is perfect print on the blade and then is taken as the reference picture to compare with the images taken by the module after a particular interval of time. There is a feature in the OpenCV named Haar cascade that is utilized in the project. The algorithm called a 'Haar Cascade' is utilized in order to measure the brightness of the print on the blade. Thus, Haar cascade describe the brightness feature. The area of the blade surrounding the print on the blade is having the different intensity to that of the print itself. The Haar feature is utilized in the Raspberry Pi in order to compare the intensity of the blade prints taken by the camera module of the Raspberry Pi. Thus, quality inspector can inspect the quality of the prints on the blades by taking their images after a particular interval of time.

Fig. 19 Blades strip

The above picture shows the blade strips that are inspected with the camera module with the haar like feature of openCV. The command used for clicking picture by the camera module is as follows

```
raspistill –o image.jpg
```

The picture taken by this command appears on the screen for a short time and the image should be saved in the Home directory (/home/pi).In order to run the script printed in terminal window as it carries out its command and camera module's LED lightens up while it takes the pictures.

VIII. APPLICATIONS OF ONLINE BLADE PRINT MONITORING SYSTEM

1. To automate the inspection of blade prints
2. To reduce the need of employer
3. To inspect each blade thoroughly

IX. ACKNOWLEDGEMENT

Special thanks to Tigaksha Metallics Company for providing us endorsement for Online Blade Print Monitoring system. We would like to extend heartiest thanks to I.K Gujral Punjab Technical University for providing us opportunity for Industry Defined Project (IDP). The completion of this project could not have been possible without a support of worthy Campus Director Dr. D.S Bawa, and Dean Academics Er. H.P.S Dhami. Thanks to our HOD of ECE Dr. Charanjeet Singh for so much support and contribution. We would also like to thank our Guide Er. Rajat Joshi for helping us in every step of our journey of project.

REFERENCES

[1] https://www.raspberrypi.org/magpi-issues/Projects_Book_v1

[2] https://cdn.sparkfun.com/datasheets/Dev/RaspberryPi/2020826

[3] http://www.petervis.com/Raspberry_PI/Raspberry_Pi_CSI/Raspberry_Pi_CSI_Camera_Interface.html

[4] Suchitra, Suja P. and Shikha Tripathi, "Real-time emotion recognition from facial images using Raspberry Pi II", Feb. 2016, ISBN: 978-1-4673-9197-9

[5] Tussanai Parthornratt, Natchaphon Burapanonte and Wisarute Gunjarueg, "People identification and counting system using raspberry Pi (AU-PiCC: Raspberry Pi customer counter)", Jan. 2016, ISBN: 978-1-4673-8016-4

[6] B V Santhosh Krishna, J Oviya, S Gowri and M Varshini, "Cloud robotics in industry using Raspberry Pi", March 2016, ISBN: 978-1-5090-1706-5

[7] M. Vanitha, M. Selvalakshmi and R. Selvarasu, "Monitoring and controlling of mobile robot via internet through raspberry Pi board Purchase or Sign In", March 2016, ISBN: 978-1-5090-1706-5

[8] Sk Riyazhussain, Riyazhussain, P. Vamsikrishna, C.R.S. Lokesh and Goli Rohan, "Raspberry Pi controlled Traffic Density monitoring system", March 2016, ISBN: 978-1-4673-9338-6

[9] V. Pasquali, R. Gualtieri, G. D'Alessandro, F. Leccese and M. Cagnetti, "Experimental in field reliability test for data logger based on Raspberry-Pi for extreme scenarios: A first step versus aerospace applications", June 2016, ISBN: 978-1-4673-8292-2

[10] Sławomir Kocoń and Jacek Piskorowski, "Implementation of non-zero initial conditions for multi-notch FIR filter using raspberry Pi", Sept. 2016, ISBN: 978-1-5090-1866-6

[11] Roland Szabó, and Aurel Gontean, "Industrial robotic automation with Raspberry PI using image processing", Sept. 2016, ISBN: 978-80-261-0602-9

[12] Kristian Hentschel, Dejice Jacob, Jeremy Singer and Matthew Chalmers, "Supersensors: Raspberry Pi Devices for Smart Campus Infrastructure", Aug. 2016, ISBN: 978-1-5090-4052-0

[13] Prachi H. Kulkarni, Pratik D. Kute, and V. N. More, "IoT based data processing for automated industrial meter reader using Raspberry Pi", Jan. 2016, ISBN: 978-1-5090-0044-9

[14] Okky Permatasari, Siti Ummi Masruroh, and Arini, "A prototype of child monitoring system using motion and authentication with Raspberry Pi", April 2016, ISBN: 978-1-4673-8443-8

[15] Enis Bilgin and Stefan Robila, "Road sign recognition system on Raspberry Pi", April 2016, ISBN: 978-1-4673-8490-2