

FABRIC DEFECT DETECTION FOR TEXTILE INDUSTRY: A PROTOTYPE

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Abstract

In this era, usage of fabric is very popular among people. It is not only used by human for clothing but also used for curtains, pillow skin and many more. In relation to that, the demand of fabric is rising from day to day. The problem is, customers always complain about the quality of the fabric as it has so many defect and the defected fabric should not be sold. This project aims to create a fabric defect detection prototype that can detect the defect on fabric based on colour. The method used in this system were using Arduino and colour sensor that is able to detect defection on a fabric. The defects are holes or colour defects presents on the inspected fabric. As a result, if any defect been found, the conveyor will stop and the buzzer and LED will turn on to notify the worker in charge to remove the damaged fabric from production line. Then, liquid-crystals display (LCD) will simultaneously display the type of defect that has been found either hole or colour defect or both. This project can help to reduce the loss of fabric production industries. As conclusion, this project will help the company to maintain their quality of the production by reducing the chances of defected fabric from get into market.

Index Terms-- Fabric, Defect detector, Colour sensor, Hole defect, Arduino.

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INTRODUCTION

Fabric is a material that is used by everyone all over the world to make shirts, pants, curtains and many more. As to maintain the quality in the textile industry, defect detection plays an essential role in order to maintain the quality of the production (Sharda P. Jadhav, 2014). Before advanced technology came, most of the industries in Malaysia used conventional way in finding the defect by using human efforts which is not cost effective (Hoseini et al, 2013). Furthermore, this way is not practical anymore to company who are dealing with a lot of production of fabric.

There are a few types of fabric detection machine available in industries today. They already have a lot of types of machine which assign to find the defect on fabric which has their own method, characteristics, strengths and weaknesses (Ngan et al, 2011). All of it was created based on the application required for any defect finder on fabric such as on the colour and hole. A fabric defect detection machine is very practical and economical process which it can find the defect located on the fabric that move along the conveyor.

Compare to other fabric imperfection discovery machine, they utilize image processing. The model fabric deformity identification prototype in view color code using color sensor has its own particular superiority. This model is much cheaper than utilizing the image processing but still the outcome is the same class as each other.

PROBLEM STATEMENT

Human eyes are limited in checking any defect of fabric production in larger quantity. It became harder when the fabric is on the moving conveyor with larger quantity.

According to Li P. et al (2015), although with low efficiency, poor accuracy, high missing rate and human factors, human vision inspection has occupied the dominant position in practical production, which will no longer meets the need of modern textile industry. For a long time, the fabric defects inspection

process is still carried out with human visual inspection, and thus, insufficient and costly (Mahajan P.M. et al, 2009).

Detection and classification of defects is time consuming and tiring. (H.İ. Çelik et al, 2014). Since there are too many defects has been overlooked by the worker, it caused a lot of rejected fabric which led to company loss. The company's reputation and quality of product can also be compromised.

Many attempts are made to replace the traditional human inspection by automated visual systems. The automated visual inspection system employs camera system and image-processing routines (H.İ. Çelik et al, 2014). Fabric defect detection machines nowadays using image processing techniques as it can detect more defect, but it is costly.

Thus, this study aims to develop a prototype of fabric defect detection machine that can detect the defect based on colour code by using colour sensor with microcontroller.

RESEARCH METHODS

The methods start with hardware development which consist of making the conveyor, complete the circuit diagram and design the whole system. Next is software development, where complete coding for Arduino are needed and also we need to construct GUI for the system using the LCD display and Microsoft Visual Basic. After both software and hardware development is completed, it continues with the system testing.

A. Hardware Development

Overview of the process are given in the Figure 01. The sensor acts as the input for Arduino to execute the defect detection process. Fabric defect detection process in this project are based on the colour. The fabric that flow along the conveyor will be inspect by the colour sensor that has been set. Then, input signal determined by the sensor will be processed and converted into voltage value, different colour will give different voltage value. This value was transferred to Arduino board for defect detection process.

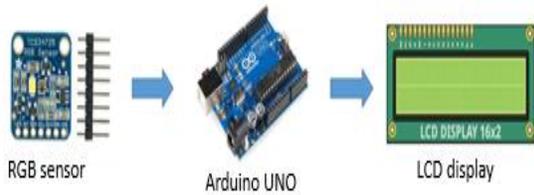


Figure 1. Project Overview

If a hole are detected on the fabric, a black colour code will show at the system. The motor that control the conveyor movement

will stop, the defected notification will display on the LCD and will trigger alarm on buzzer and LED. After that, the flow continue to detect a defect on any abnormal colour. If the defect is found, it will stop the conveyor movement, display the notification on the LCD and trigger alarm to buzz again. Lastly, the flow goes to last decision which is "button press". If the decision is "yes", the system will rerun the motor and reset the alarm and the system will start all over again from the beginning. If the decision is "no" then the whole system come to its end and the process has completed. The defect detection process summarized in Figure 02 is repeated for each fabric image frame.

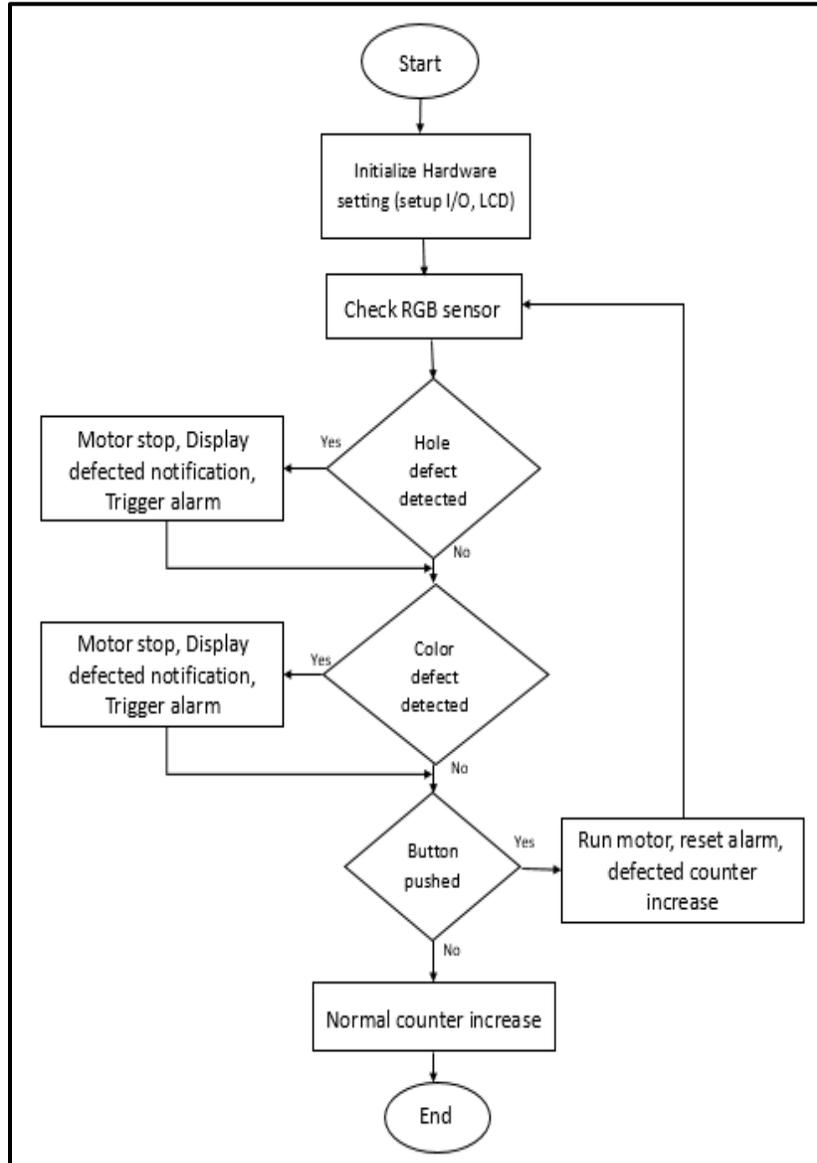


Figure 2. Flowchart of defect detection

Circuit Diagram

Figure 03 shows all the components that involve in this project and how the connection is done. The circuit is much easier to understand the mechanism and for troubleshooting purpose.

The circuit diagram is used to show how the connection from end to end point are made between each component so that it will have the complete circuit. The components are:

1. Colour sensor
2. Arduino Uno R3
3. LCD Display 16x2
4. Buzzer
5. Power supply 12v
6. Switch push button

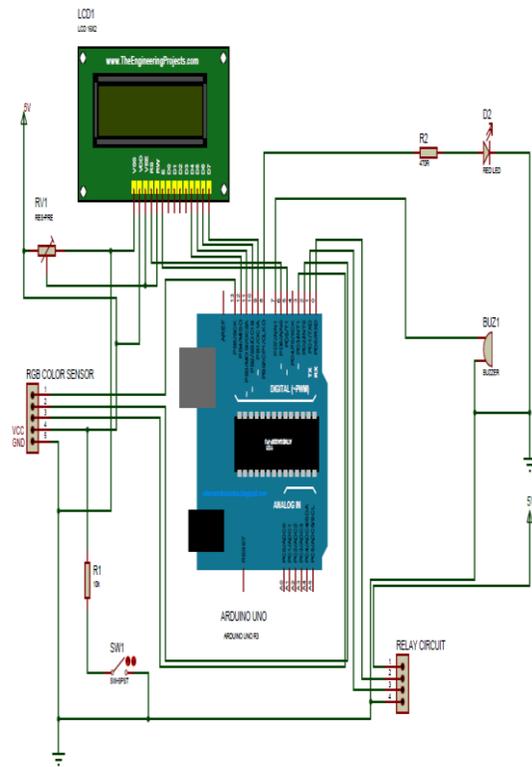


Figure 3. Circuit diagram

B. Software Development

All programming has been done in Arduino IDE. The language used in the software is basically based on C++ language. IDE is referred to Integrated Development Environment or also called Arduino Software. The example of the IDE interface which contain the command and language is shown in the Figure 04.

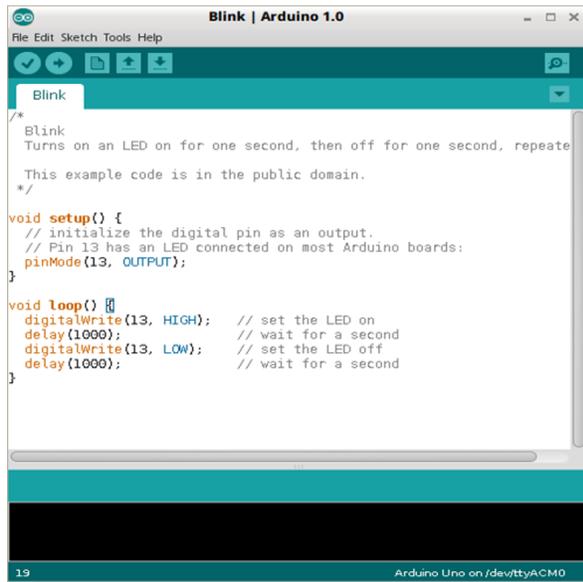


Figure 4. IDE interface

Programs key in using Arduino Software (IDE) are called sketches. These sketches are written in the text editor (Figure 05) and are saved with the file extension .ino. The text editor is a type of program that use to edit plain text files. It is sometimes

known as notepad. It is also come with operating systems and software development packages and can be used to change configuration files, documentation files and programming language source code.

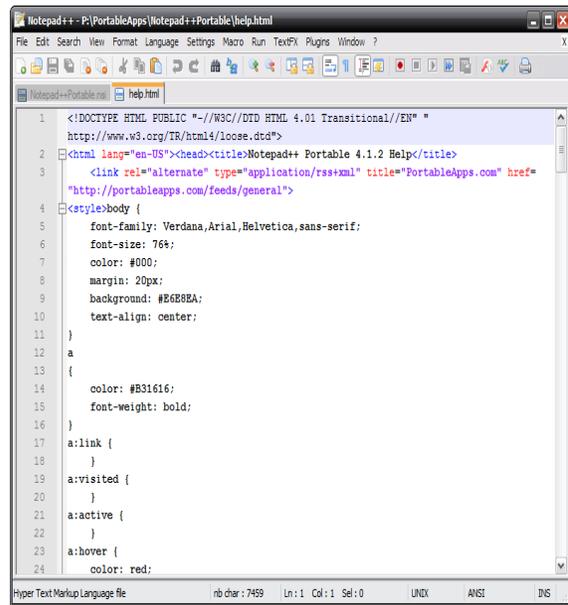


Figure 5. Text editor interface

Microsoft Visual Basic software, Visual Basic (VB) is a programming environment from Microsoft in which a programmer uses a graphical user interface (GUI) to choose and modify preselected sections of code written in the basic programming language. It is used to store and monitor the data collected from the system.

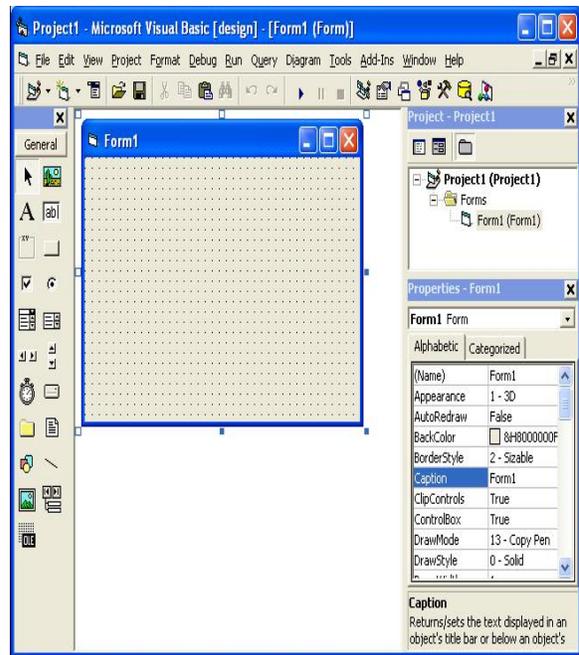


Figure 6. Microsoft Visual Basic interface

FINDINGS

A. Hardware set up

The hardware setup is consist of power supply, conveyor, motor, color sensor, LCD display, motor driver, arduino, buzzer and push button as shown in Figure 07.

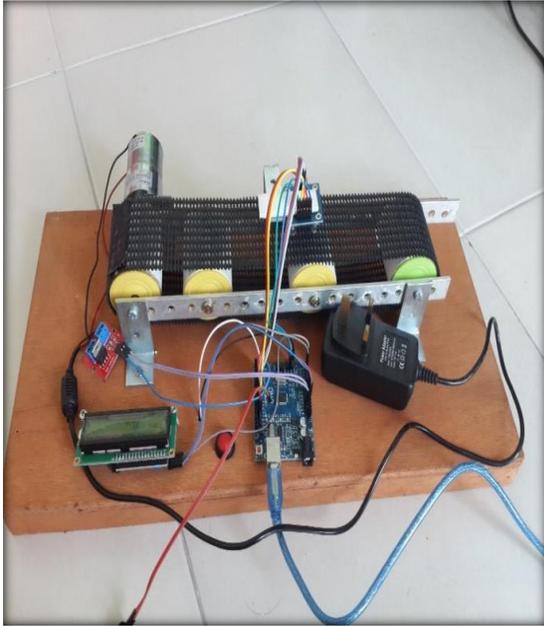


Figure 7. Prototype

The main components in this prototype is the conveyor, Figure 08 as they assign to move the sample of inspection. The conveyor mechanism cannot work if any of the component are malfunction.

The speed of the conveyor is controlling directly by the system. The conveyor is made up from four rollers in order to make the conveyor firm and strong. The conveyor belt is made up of rubber. This is because it is effective to make the belt stays on the roller and to prevent it from slipping.



Figure 8. Conveyor

LCD display is used as the second GUI which directly used by the operator that work with the prototype. When a defected item has been found, the operator must take action to remove it and start to move the conveyor again. The LCD will display the type of mode that are chosen for the inspection.

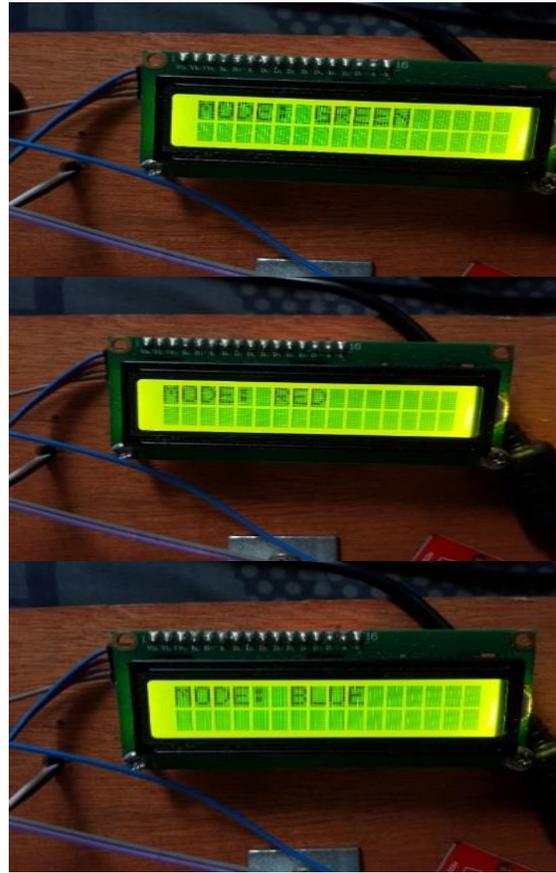


Figure 9. LCD display: mode

Figure 09 shows the command that displayed by LCD. There are three types of modes that are set in this project which is green, red and blue mode. If there is any defect being found, the LCD will display the type of defect that being detected by the system. There are two types of defect that will display by LCD which is holes and color defect, Figure 10.

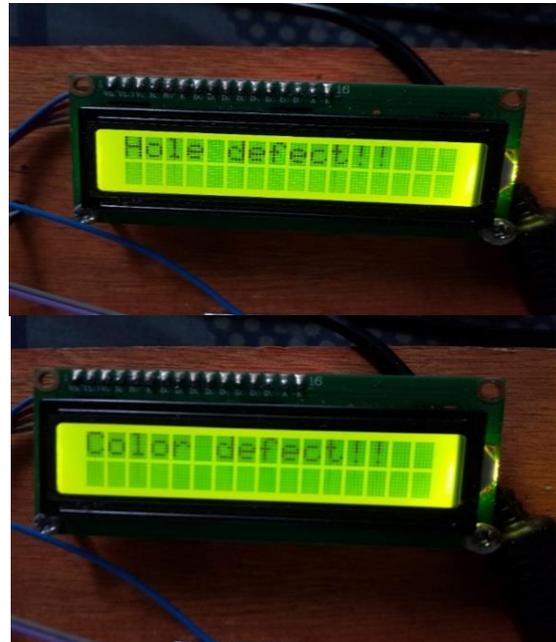


Figure 10. LCD display: type of defect

B. Software set up

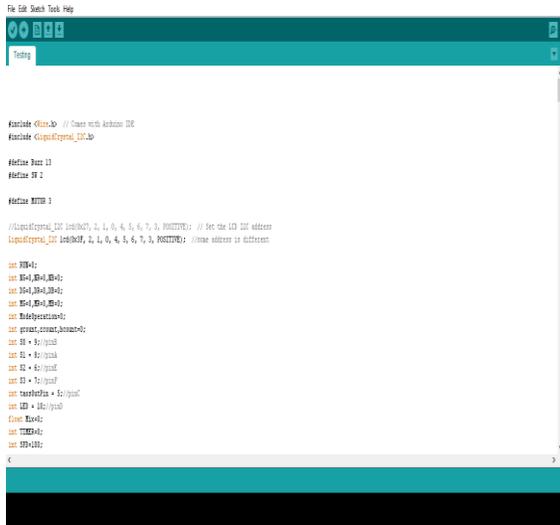


Figure 11. Arduino IDE codes

Arduino IDE is used to store all the command that works for the whole project. It is also the part where all the range value for colour being set, Figure 11.

Microsoft visual basic is used as a main GUI where it can give a direct command of changing the mode, reset data, start and stop the detection process. It also use to store all the data onto the sample that has been going through the inspection. So the operator can always look back at the previous data as it is store in the visual basic as it is real time data collector for future quality improvement, Figure 12.

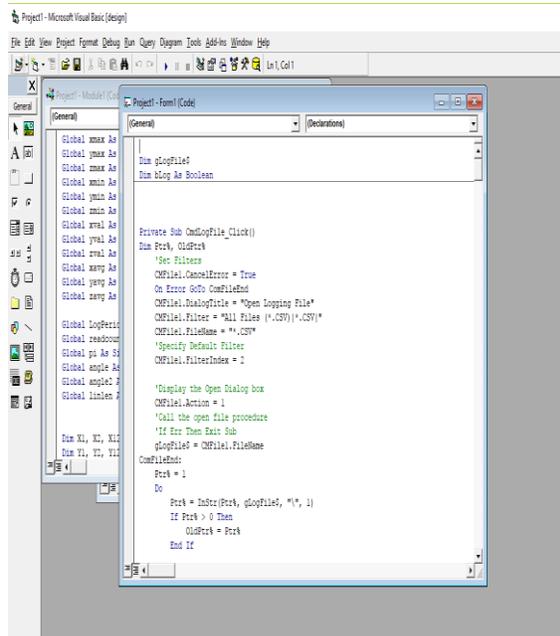


Figure 12. Microsoft visual basic codes

C. Result Analysis

Experiment result: Red mode

Once the mode has selected and run, it will display mode red on the LCD (Figure 13) and display run mode on Visual Basic (Figure 14) where the counter on LCD shows NR for normal red and DR means defected red. The result that collected from the

experiment was 15 sample of normal red and 5 sample were defected red. Both of the data will display in both LCD display and Visual Basic.



Figure 13. Result on LCD



Figure 14. Result Visual Basic

For green and blue mode, it has the same concept as the red mode, once the mode has selected and run, it will display mode green or blue on the LCD and display run mode (green or blue color) on Visual Basic.

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CONCLUSION

Fabric defects detection project can be used and implement on real industries because it helps us to enhance the inspection on fabric and benefit all the people out there. Furthermore, this fabric defect detection can reduce the manpower by using automated detection which can avoid the defected fabric from going into market and enable to store the information on defected fabric for future quality improvement to the production.

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