1 Introduction

1.1 Purpose

The main purpose of this project is to predict the value of a resistor using machine learning and image processing techniques.Traditionally resistance of a resistor is being calculated manually using color chart which consists of color codes.There are 12 colors are there in the color chart which includes black,brown,red,orange,yellow,green,blue,violet,gray and white. The other two colors are gold and silver which represents the tolerance of a resistor and it can be (+/-) 5% or (+/-) 10% respectively. Using the above information resistance is calculated. It is a time taking process. Another way to find the value of a resistance is using a hardware device called multimeter.
The project Resistor Value Prediction aims in finding the value of a resistor from resistor images.We consider 4 bands resistor for this project.Through image processing technique different color bands are identified and then machine learning algorithm is applied for training purpose.

1.2 Product Scope

This system is able to automate resistance calculation when a test resistor image is loaded into it.Some sort of preprocessing is done to the loaded remove noises and to make it smooth.Then edge detection is performed as initial step in object identification.After contouring the edges we get the region of image.Then band extraction is carried to detect the color bands ,background color subtraction method is used identify each bands from the background.Background color is thus ignored. Thus value can be calculated. this calculated value is cross checked for its accuracy through machine learning.Here K nearest neighbor is used for the classification purpose. We prepare datasets which is labeled with its resistance value.For giving a graphical user experience a simple web framework like Bottle is used.

2 The Overall Description

2.1 Product Perspective

This system can be implemented in any environment.Using this, resistance values can be calculated accurately with resistor image.For that it uses two major technologies like image processing and supervised learning.Therefore the accuracy will be there compared to manual method.At present this system consider only 4 band resistors

2.2 Product Function

- object detection
- region of image
- band detection
- color extraction
- resistance calculation
- machine learning prediction

2.3 Operating Environment

Hardware Requirements

- Processor : intel core i8
- Memory : 8GB RAM
- Storage : 1TB

Software Requirements

- Operating System : Ubuntu 16.04
- Platform : OpenCV,Python

3 Functional Requirements

This project consists of mainly of 4 modules.

1. **Object Detection**

   Object detection part of the project identifies the resistor object from the preprocessed image.Initially image is segmented and thresholding is applied.Then edge detection is performed

using canny Edge detection algorithm followed by contouring method.Then bands will be extracted.

2. **Color Extraction**

   Subtracting the background part colors of each bands are identified.

3. **Color code mapping**

   Extracted colors are mapped to each color in the color chart to find the similarity and thus value is obtained

4. **Supervised Learning**

   Supervised learning techniques such as regression and classification is applied in this module which also helps in the prediction of resistance value.Various algorithms are implemented here to check the accuracy and the best algorithm is chosen.

4 Nonfunctional Requirements

4.1 Performance Requirements

The main performance requirements that the product should satisfy are:

- Accuracy: Accuracy in functioning and the nature of user-friendliness should be maintained in the system
- Speed: The system must be capable of offering speed.

4.2 Quality Requirements

The most important quality requirements that the system should satisfy are:

- Scalability: The software will meet all of the functional requirements without an unexpected behavior.
- Maintainability: The system should be maintainable. It should keep backups to atone for system failures, and should log its activities periodically.
- Reliability: The acceptable threshold for down-time should be long as possible. i.e. mean time between failures should be large as possible. And if the system is broken, time required to get the system back up again should be minimum.
- Testability: The proposed system should be properly tested under various circumstances in order to assure its reliability.

5 Conclusion

A resistor color code recognition method is proposed to automatically estimate the resistance value of the resistor. Firstly, a preprocessing method is applied to the input image to make the proposed method invariants to noise and illumination artifacts.Then object detection is performed.Once it is done region of interest is identified to extract band colors removing the background color.After completing image processing steps next is the application of supervised learning techniques to improve the results.Automating the above process provide a huge advantage to the industry. The value of resistors kept on the circuit board can be identifying by using its image rather that the physical one.It also help other people who are working with resistors to get the value.Manual errors can be minimized using this.