

# COUNTERFEIT BANKNOTE DETECTION & COUNTING

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**  
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**BORANG PENGESAHAN STATUS LAPORAN**  
**PROJEK SARJANA MUDA II**

**Tajuk Projek** : Counterfeit Banknote Detection & Counting

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Special dedicated to my beloved parents and friends.

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In the Name of Allah almighty and the most Merciful and Blessing  
Be upon His Messenger prophet Muhammad s.a.w and his  
Companions

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## ABSTRACT

Nowadays, money is one of the basic needs for survival. This is because most of the transaction nowadays is using the money. In Malaysia, the currency used is Ringgit Malaysia. Ringgit Malaysia has evolved to increase the safety and use of money in accordance with the latest developments and Bank Negara Malaysia has issued a fourth series of Malaysian currency. However, even though the currency has released the fourth series of banknote still have a party or individuals was making or printing counterfeit money although not less than a year, whereas the new currency introduced. This is evidenced by the discovery of a new series of counterfeit money by the banks and has been published in local newspapers on 21 November 2012. Due to that, this project is to make a device are intended to help consumers or traders to not be deceived by counterfeit money. For those who less concerned about the security features available on the currency, this device will automatically detect the originality of money, so the problem would not arise if the user doesn't know about the existing security features of the money. UV light is the use of this device to show the difference between original and fake banknote because an original banknote has a mark that will reflected by UV light and Image processing by using Matlab is used to process the image of the banknote and the result will be shown in Matlab GUI. This device also can count the amount of banknote automatically and save the counted amount in one day.

## ABSTRAK

Pada masa sekarang wang adalah salah satu dari keperluan asas untuk hidup. Ini kerana kebanyakan urusan jual beli pada masa kini adalah menggunakan wang. Di Malaysia matawang yang digunakan adalah Ringgit Malaysia. Ringgit Malaysia telah berevolusi untuk meningkat lagi ciri keselamatan dan kegunaan wang mengikut perkembangan semasa dan yang terbaru Bank Negara Malaysia telah mengeluarkan siri keempat matawang Malaysia. Akan tetapi walaupun matawang siri keempat telah dikeluarkan masih terdapat pihak atau individu yang tidak bertanggungjawab membuat atau mencetak wang palsu walhal belum sampai setahun matawang baru dikenalkan. Ini dibuktikan oleh penemuan wang palsu siri baharu oleh pihak bank dan telah disiarkan di akhbar-akhbar tempatan pada 21 November 2012. Oleh itu alat ini dihasilkan adalah bertujuan untuk membantu pengguna atau peniaga supaya tidak tertipu dengan jenayah pemalsuan wang. Bagi yang kurang mengambil berat terhadap ciri keselamatan yang ada pada matawang pula alat yang akan dihasilkan ini akan mengesan ketulenan wang secara automatik, jadi masalah tidak akan timbul jika pengguna tidak tahu mengenai ciri keselamatan yang ada pada wang. Cahaya UV akan digunakan dalam alat ini untuk menunjukkan perbezaan antara wang kertas tulen dan palsu kerana wang kertas yang tulen mempunyai kawasan yang bertindakbalas dengan cahaya UV dan pemrosesan imej dengan menggunakan Matlab digunakan untuk memproses imej wang kertas dan hasilnya akan ditunjukkan dalam Matlab GUI. Alat ini juga boleh mengira jumlah wang kertas secara automatik dan menyimpan jumlah yang dikira dalam satu hari.



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## LIST OF ABBREVIATIONS

**2D** : 2 Dimension

### **B**

**BMP** : Bitmap

**BNM** : Bank Negara Malaysia

**BW** : Black and White

### **C**

**CPU** : Central Processing Unit

### **G**

**GUI** : Graphical User Interface

### **H**

**HDF** : Hierarchical Data Format

### **J**

**JPEG** : Joint Photographic Experts Group

### **M**

**Matlab** : Matrix Laboratory

**P** : Projek Sarjana Muda

**PSM**

**R** : Red Green

**RGB** : Ringgit Malaysia

**RM**

**U** : Universal Serial Bus

**USB** : Ultraviolet

**UV**

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

This chapter discusses on project background where problem statement and introduction are stated. Objectives, scopes, challenges faced, significance of project and research methodology are also highlighted to carry out of this project more vividly. An outline of the report has been drafted to assist in making this project working smoothly.

#### **1.2 Project Background**

Counterfeit banknote detection and counting is a highly effective device to prevent the counterfeit money. It can easily be applied to identify Banknotes, it has the features of good presentation, easy operation, and accurate in counterfeit identification. Counterfeit detector is a multifunctional testing device which can be widely used in Retail-sales Shops, Financial Centers Banks, supermarkets, etc. Besides that Counterfeit banknote detection and counting can also be used to calculate the amount of money and save the total amount for 1 day. This device will also display the amount of money that is calculated and the value of money put into

the machine and if the counterfeit money is detected it will inform the user that 'This is not Malaysia new money' at the display screen.

### 1.3 Problem Statement

Nowadays there are many counterfeit money crimes that happen in Malaysia, hence the Bank of Malaysia has issued new Banknote to overcome this problem, but it is not 100% successful in destroying counterfeit money problem in Malaysia, therefore this tool will help the Bank of Malaysia and the police to reduce crime in Malaysia counterfeit bills. Nowadays, not only big value banknote like RM50 and RM100 is counterfeited, even smaller value of banknotes like RM1 and RM5 has also counterfeited. Other than that, not all of us know the security feature of new banknote and it is also difficult to see the difference within counterfeit and original money by using human eye. Because of that this device will detect the originality of banknote automatically and displays the image of the banknote surface that will usually absorb the UV light and will show special marks made with fluorescent ink.



**Figure 1.1: Seller Has Received Counterfeit Banknote**

Sellers usually only able to detect counterfeit money they received after going to the bank for deposit their money. So they fail to detect who has been using the counterfeit money. With this device, after detecting the counterfeit money sellers can immediately contact the police to report the incident and if they have a security

camera on their premises, it will facilitate the police to track the users of counterfeit money. Figure 2.1 shows the newspaper report about counterfeit banknote crime and a new series of banknote had been counterfeited.

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**Lapan terlibat sebar wang palsu ditahan**

WARTAWAN SINAR HARIAN  
21 November 2012

BUKIT BERUANG - Polis menahan lapan individu berusia antara 22 dan 26 tahun sepanjang tahun ini bagi membantu siasatan ke atas penyebaran wang palsu di negeri ini.

Ketua Jabatan Siasatan Jenayah Komersial Negeri, Superintendan Soh Hock Sing berkata, daripada jumlah itu, seorang telah dituduh di mahkamah kerana memiliki wang palsu berkenaan.

Menurutnya, daerah Melaka Tengah mencatatkan bilangan tertinggi dalam penyebaran wang palsu dengan 51 kes, diikuti daerah Alor Gajah dan Jasin, masing-masing enam dan satu kes.

"Kebanyakan wang palsu ini diedarkan di tempat-tempat sibuk seperti di pasar-pasar malam serta pusat hiburan, di mana mangsa seringkali tidak mempunyai masa untuk memeriksa keaslian wang yang diserahkan kepada mereka.

"Premis perniagaan boleh mengesan keaslian wang kertas yang diserahkan dengan menggunakan mesin UV (ultra violet atau ultra ungu), sebagaimana digunakan di bank dan pusat membeli-belah," katanya pada sidang media di Ibu Pejabat Polis Kontinjen (IPK) Negeri, di sini semalam.

Sementara itu, katanya, dalam kes terbaru, seorang ahli perniagaan berdepan tindakan apabila sebuah bank membuat laporan polis terhadapnya selepas beberapa keping wang kertas dan sejumlah RM13,000 yang beliau masukkan ke dalam akaunnya didapati palsu.

Menurut Hock Sin, dalam kes berkenaan, 10 keping wang kertas RM100 yang dimasukkan ahli perniagaan berkenaan ke dalam akaunnya didapati palsu.

Menurutnya, ada sebilangan mangsa dalam usaha mengelak kerugian selepas menyedari wang mereka adalah palsu, masih cuba memasukkan wang berkenaan ke dalam akaun.

"Kebanyakan mangsa wang palsu biasanya akan mudah tertipu apabila menerima sejumlah wang yang besar tanpa memeriksa dengan teliti keaslian wang berkenaan," katanya.

Hock Sin berkata, ketebalan wang asli dan palsu adalah berbeza dan sehubungan itu, kedua jenis ini boleh dibezakan menerusi sentuhan.

SOH Hock Sing menunjukkan perbezaan wang palsu RM100 (atas) dan wang asli (bawah) akhbar di IPK Bukit Beruang, Melaka, semalam. - UTUSAN/ AZLI AHAD

**Figure 1.2: Newspaper Report About Counterfeit Banknote Crime in Malaysia**

## 1.4 Objectives

The objectives of this project are:

- i. To provide a device that can detect counterfeit new banknote and count the amount of banknote automatically.
- ii. To provide a device that uses a webcam, UV light and Matrix Laboratory (Matlab) software to detect a value and originality of banknotes.

The first of these aims is to provide a device that can detect counterfeit of all new banknote RM1 to RM100 and count the amount of banknote automatically. The device is able to detect counterfeit banknote for RM1 to RM100 because not only the big amount of the banknote has a probability to be counterfeited, the small amount of banknote still has a probability to be counterfeited. For count the amount of banknotes, all the 4th series of new Malaysian banknote RM1 to RM100 are able to count with this tool. Secondly is to provide a tool that uses a webcam, UV light and Matlab software to detect a value and originality of banknotes. The device will use a webcam because other than capture the image of banknotes to be processed, it can show user the image of banknote while in the process in the tool. UV light is chosen because each value of banknote RM1 to RM100 absorbs the UV light and will show special marks made with fluorescent ink. For software, Matlab is chosen because this software can do the image processing to distinguish whether the banknote is counterfeit or original. Other than that Matlab have their graphical user interface (GUI) that allows users to interact with electronic devices using images rather than text commands, it will help us deliver information and results to the user more efficient and clearly.

## 1.5 Scope of the Project

Firstly, to analyze how to detect banknote from the security feature of the new banknote issued by Bank Negara Malaysia, this project selected several features to be used as a guide to identify the genuine banknote. The hardware that used to detect genuine banknote is:

- i. UV light lamp to check stag motif and a rectangle with text “BNM 100/50/20/10/5/1” and another mark reflect by UV light.
- ii. Webcam to capture and send images of banknote to be processed.

Then develop the software for counting and process images to identify whether the banknote was genuine or fake. After that the count value or the result of the process image will be sent to the display screen. Matlab is used to make a program that can count money and detects the genuine of banknote and also to make a GUI as an interface to the user.

## 1.6 Outline of the Project

This report consists of six chapters which are Introduction, Literature Review, Methodology, Results & Analysis, Discussion, and Conclusions & Recommendations. Each chapter has all information that related to this project and it's described as below:

Chapter 1, explain the background of the project, the problem statement that identifies, objectives of the project, the scopes and limitations, challenges that faced to do this project, suitable methodology that will be used, and outline of the project's report.

Chapters 2, is about the image processing concept that related to this project. The processing to detect originality of banknote by using software and hardware is

studied, and all carry that information out from journals, books, articles, etc. are carried out.

Chapter 3, describe details all methods that used to make sure this project planning going smoothly. All procedures to make any improvements related to this device are explained specify in order to do this project for both PSM 1 and PSM 2.

Chapter 4, describe details about all data that will be analyzed to get the result of implementation of this project. The root causes of rejecting part also highlight for improvement team that can use the information to take further action.

Chapter 5, present the whole of this project progress until done which is achieving the objectives or not to make conclusions and give recommendations that related for further research or study.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter contains the literature review of the study relates to the scope of the study. It covers the definition of work process, work measurement and especially focusing on the study how to detect banknote element. Sources of the information were obtained from articles, journals, and some books related to the study. Each source was selected based on the similarity with the scope of the study. At the end of this chapter, the elements will be narrowed down to the assessment method used for the study. From the scope of this project, UV light, webcam and Matlab is used as the method to detect the genuine banknote and literatures found based on the scope of the project.

#### **2.2 New Banknote Features**

Bank Negara Malaysia (BNM) has announced the introduction of a new series of Malaysian Banknotes through its press statement on 21 December 2011. This 4th series of Malaysian Banknotes consists of denomination of RM1, RM5, RM10, RM20 and RM100 which will be circulated in the second half of 2012. The earlier issued or

circulated RM50 is part of the new series. RM1 and RM5 are issued in the form of polymer notes.

Other than that, this 4th series of banknotes is placed with safety features in line with the latest advancements in banknote technology. The security features of the 4<sup>th</sup> series of notes are included a watermark portrait with pixel and highlighted numerals, shadow image, clear window, micro lens thread, color shifting security thread, perfect see-through register, colored glossy patch for public recognition. In addition a banknote has included tactile identification which enables the visually impaired to identify and distinguish the different denominations.

The technical specifications for the fourth series and existing banknote series about the substrate and predominant color are as follows in Table 2.1 and Table 2.2:

**Table 2.1: Fourth Series of Malaysian Banknotes Specification**

Denomination	Substrate	Predominant Color
RM100	Paper	Purple
RM50	Paper	Green-blue
RM20	Paper	Orange
RM10	Paper	Red
RM5	Polymer	Green
RM1	Polymer	Blue

**Table 2.2: Existing Banknotes Series Specification**

Denomination	Substrate	Predominant Color
RM100	Paper	Purple
RM50	Paper	Green-blue
RM10	Paper	Red
RM5	Polymer	Green
RM2	Paper	White purple
RM1	Paper	Blue