Volume 9, Issue 4, April – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2080

Detection and Counting of Fake Currency & Genuine Currency Using Image Processing

Nimish Bodkhe[1]; Deep Bodkhe[2]; Ayush Tayade[3]; Sarvesh Makode[4]; Dr. Nikkoo Khalsa[5]
[1,2,3,4,5]Department of Electronics & Telecommunications Engineering,
Prof. Ram Meghe Institute of Technology & Research, Badnera, Amravati

Abstract:- In today's digital age, the proliferation of counterfeit currency poses a significant challenge to financial institutions and businesses worldwide. The detection and prevention of counterfeit currency transactions require advanced technological solutions to safeguard the integrity of financial systems. In our research, we present a novel approach to tackle this problem by leveraging image processing techniques. The proposed system utilizes state-of-the-art image processing algorithms to distinguish between fake and genuine currency notes accurately. By analyzing various features such as texture, color, and watermark patterns, our system can effectively identify counterfeit currency notes with high precision. Additionally, the system is capable of counting and validating genuine currency notes, providing a comprehensive solution for currency authentication and management. The integration of image processing technology into currency verification systems offers numerous benefits, including enhanced accuracy, speed, and reliability. Our research aims to contribute to the development of robust and efficient solutions for combating counterfeit currency fraud, thereby safeguarding the integrity of financial transactions and promoting trust in monetary systems.

Keywords:- *Image Processing, Fake Currency Detection, Genuine Currency Detection, Counterfeit Currency Detection , Financial Security.*

I. INTRODUCTION

In today's interconnected world, the circulation of physical currency remains a cornerstone of economic transactions, despite the increasing prevalence of digital payment methods. However, alongside the convenience of cash transactions comes the persistent threat of counterfeit currency, a challenge that continues to evolve with technological advancements. The ability to accurately detect and distinguish between genuine and fake banknotes is not only crucial for maintaining the integrity of financial systems but also for preserving trust and confidence in currencies worldwide.

The research paper titled "Detection and Counting of Fake Currency & Genuine Currency Using Image Processing" addresses this pressing issue by exploring innovative approaches to counterfeit currency detection leveraging image processing technologies. In recent years, the field of image processing has seen remarkable progress, driven by advancements in machine learning and computer vision. These developments have opened new avenues for the rapid and accurate identification of counterfeit banknotes, offering potential solutions to combat financial fraud.

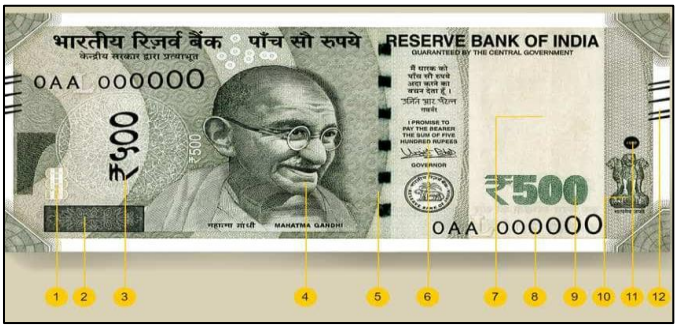


Fig 1: 500 Rs. Note with 12 identity marks

Traditionally, counterfeit currency detection has relied on manual inspection or specialized machines, which are often time-consuming and prone to human error. Moreover, counterfeiters continuously adapt their techniques to mimic the intricate features of genuine currency, posing a persistent challenge to conventional detection methods.

In response to these challenges, the paper proposes a novel approach that harnesses the capabilities of Google TensorFlow, Teachable Machine, Java, Embedded C language, Arduino, and Android Studio software to achieve real-time detection and counting of currency notes.

By integrating these cutting-edge technologies, the research paper seeks to address the limitations of existing counterfeit currency detection methods and pave the way for more efficient and reliable solutions.

The proposed system offers a comprehensive framework for simultaneous image processing, enabling seamless communication between an Android mobile device and a currency note counting machine. Through a detailed methodology, the paper outlines the steps involved in initializing the hardware, establishing Bluetooth connectivity,

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2080

and implementing image processing algorithms for counterfeit currency detection.

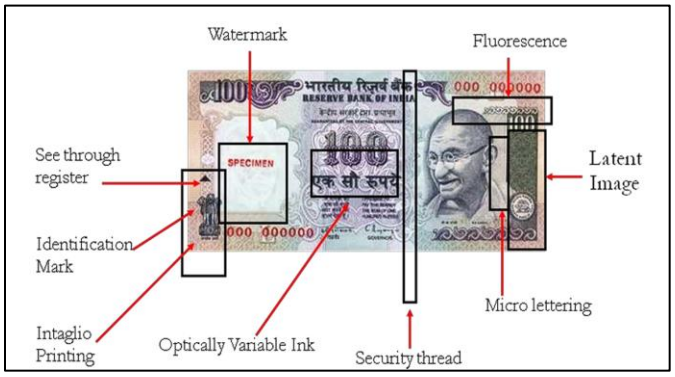


Fig 2: 100 Rs. Note

Furthermore, the paper highlights the practical implications of the proposed system, emphasizing its potential to streamline currency verification processes, enhance security measures, and mitigate financial losses resulting from counterfeit currency circulation. By providing a deeper understanding of the underlying principles of image processing and machine learning, the research paper aims to contribute to the advancement of counterfeit currency detection techniques and foster greater resilience against financial fraud in the digital age.

In essence, the research paper serves as a testament to the transformative power of image processing technologies in safeguarding the integrity of global financial systems and upholding trust in currencies worldwide. Through continuous innovation and collaboration, it is envisaged that such advancements will play a pivotal role in shaping the future of currency authentication and ensuring the resilience of economies in an increasingly digital and interconnected world.

II. LITERATURE SURVEY

In this paper, author suggest a highly useful and effective technique for detecting fake currency. Counting the quantity of disruptions there in thread line is used to detect fake cash notes. The number of interruptions can be used to find out if a note is authentic or counterfeit. If there are no interruptions, it is genuine; otherwise, it is a fake.

They also compute the entropy of money notes to detect fraudulent currency notes more effectively. The bogus money note is detected using MATLAB software.(Pallavi S1, Pooja N2, Yashaswini HR3, Varsha N4). [1]

In described an approach for recognizing paper currency that depended on Hidden Marko Model (HMM). HMM was utilized to model the banknote texture as a random operation. The pre-processing stage was necessary to solve the problem of identifying dirty banknotes. The attribute vectors for various banknotes were stored in a database for paper currency identification.[2]

Automatic authentication of paper money has been targeted. Indian bank notes are taken as reference to show how a system can be developed for discriminating fake notes from genuine ones. Image processing and pattern recognition techniques are used to design the overall approach. The ability of the embedded security aspects is thoroughly analyzed for detecting fake currencies.[3]

This proposed system describes an approach for verification of Indian banknotes. The currency will be checked out by using image processing techniques. The approach consists of a number of elements including processing of image, detection of edge, image segmentation, drawing out characteristic, comparing both images. The image processing approach is discussed with MATLAB to verify the parameters of note. Image processing involves changing the nature of an image in order to improve its visual information for human interpretation. The image processing software is a collection of functions that extends the capability of the MATLAB numeric computing environment. The result will be whether note is real or fake.[4]

This paper presents the various fake currency detection techniques. Fake currency is imitation currency produced without the legal sanction of the state or government. Producing or using fake currency is a form of fraud or forgery. We have reviewed different fake currency detection systems. The systems are developed using different methods and algorithms. The benefits of this study for the reader are that this study will provide information about the different methods and algorithms used for fake currency detection system. They can compare the detection systems. Detection ability depends on the currency note characteristics of particular country and extraction of features.[5]

This research article gives information on how to identify the security features of the Indian currency. It has mentioned all front side as well as reverse side features of 2000 rupees notes and 500 rupees notes. The author mentioned around twenty features like note's size, color, security threads with an inscription, number on the top left and bottom right side, emblem of Ashoka pillar on the right side, etc.[6]

In this project we have made fake currency note detection technique using MATLAB and feature extraction with HSV color space and other applications of image processing. In the project setup, note is placed in front of camera to check whether it is fake or genuine. The camera pictures of notes are analyzed by MATLAB program installed on computer. The project is meant to check Indian currency notes of 100, 500 and 1000 rupees. If the note is genuine, the respective message is appeared on the screen and vice-versa. [7]

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2080

III. METHODOLOGY

This project implements TensorFlow, a machine learning framework, on an Android device to detect fake currency. The system involves both hardware and software components working together.

First, all hardware components, including the ESP32 microcontroller, relay module, motor, and LED indicator, are connected and powered. The Android application, equipped with Bluetooth and TensorFlow integration for image processing and classification, is developed. The ESP32 waits for a Bluetooth connection, while the Android app initiates Bluetooth and searches for the device. Once connected, the user interface on the app allows users to initiate the detection process.

Upon confirmation, the app captures images of currency notes using the phone's camera. These images are preprocessed on the device and then fed into the TensorFlow model for classification as genuine or fake. The app communicates with a separate currency note counting machine via Bluetooth. When the detection process starts, the counting machine dispenses notes and calculates the total value of genuine ones. The Android app continuously receives feedback from TensorFlow about the classification of each dispensed note. If a fake note is detected, the user is alerted, and the app signals the relay module to stop the motor, preventing further dispensing. For genuine notes, the total value is updated on the app screen.

Finally, the app displays the total value of genuine notes and provides visual feedback through an LED indicator on the ESP32 . The process concludes by sending a stop signal to the counting machine, halting its operation. In essence, this methodology utilizes TensorFlow on the Android device for image classification, while a separate system handles physical dispensing and counting. Communication and control signals ensure a coordinated detection process with real-time feedback.

The system proposed here work here on the image of currency note under ultraviolet light acquired by a digital camera. The algorithm which is applied here is as follows:

- Acquisition of image of currency note under ultraviolet light by simple digital camera or scanner.
- Image acquired is RGB image and now is converted to grayscale image.
- Edge detection of whole gray scale image.
- Now characteristics features of the paper currency will be cropped and segmented.
- After segmentation, characteristics of currency note are extracted.
- Intensity of each feature is calculated.
- If the condition is satisfied, then the currency note is said as original otherwise fak.

A. Block Diagram

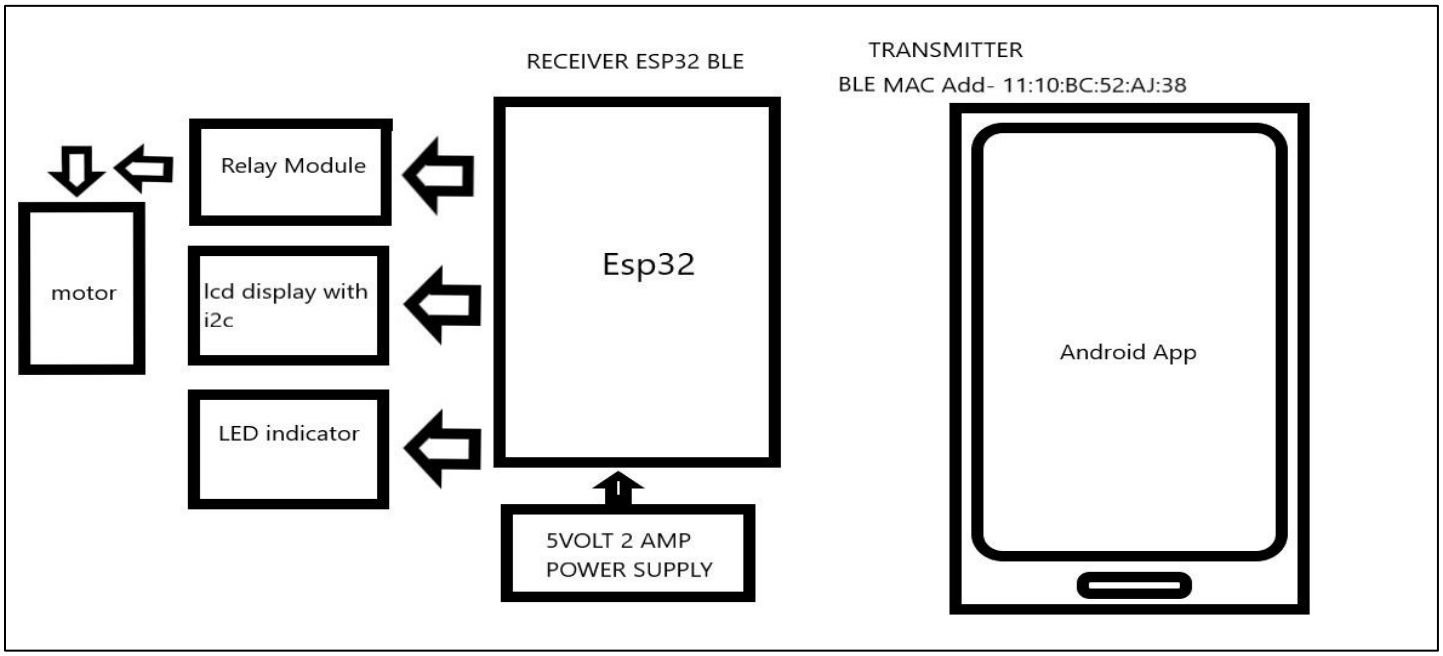


Fig 3: Block Diagram of Detection & counting of Fake currency & Genuine Currency Using Image Processing

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2080

➢ *Block Diagram Description*

- *Hardware Components:*

✓ Receiver ESP32 BLE: This is the main processing unit of the system. It is a microcontroller (MCU) with built-in Wi-Fi and Bluetooth Low Energy (BLE) capabilities. It is likely responsible for capturing the image of the currency, preprocessing the image data, performing the machine learning inference to classify the currency as fake or genuine, and transmitting the results wirelessly

✓ Relay Module: This module is likely used to control an external device, such as a solenoid or motor, based on the classification results. For example, it could be used to activate a mechanism to reject fake currency or sort genuine currency into a separate bin.

✓ Motor: This component might be used to drive a mechanism for sorting or rejecting currency based on the classification results.

✓ LCD Display with I2C: An I2C (Inter-Integrated Circuit) LCD display is likely used to show the user information about the system's operation, such as the number of genuine and fake currencies detected.

✓ 5V 2 Amp Power Supply: This component provides the necessary power to operate all the other parts of the system.

- *Software Functionality*

✓ Image Capture: The system captures an image of the currency using a camera (not shown explicitly in the block diagram).

✓ Image Preprocessing: The captured image data is preprocessed to prepare it for the machine learning model. This might involve resizing the image, converting it to grayscale, or applying filters to reduce noise and enhance relevant features.

✓ Machine Learning Inference: A pre-trained machine learning model is loaded onto the ESP32. This model likely takes the preprocessed image data as input and outputs a classification result, indicating whether the currency is fake or genuine

✓ Output and Control: Based on the classification result, the system might display the result on the LCD screen, activate the relay module to control an external device, or transmit the results wirelessly via BLE.

B. Connection Diagram

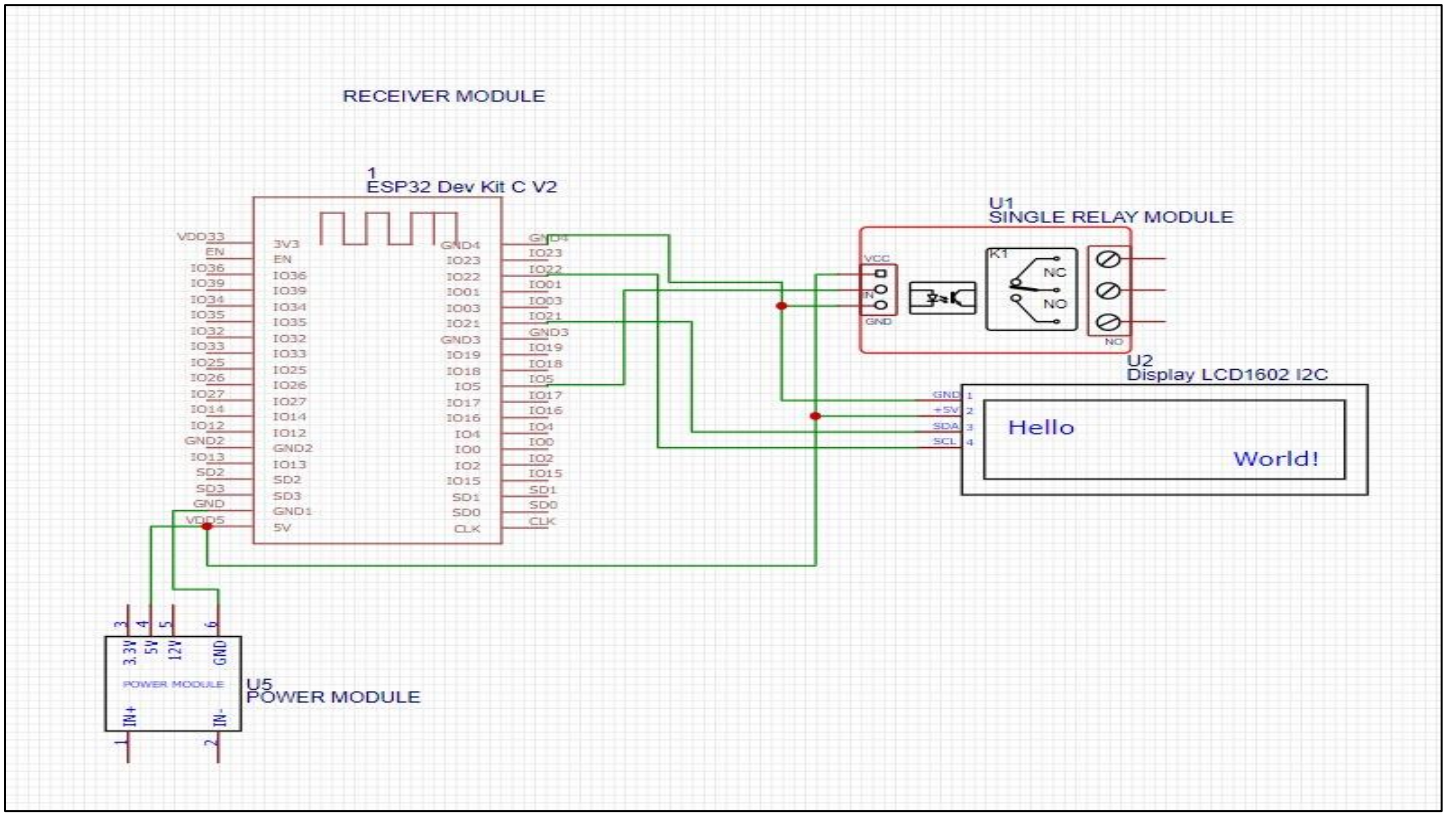
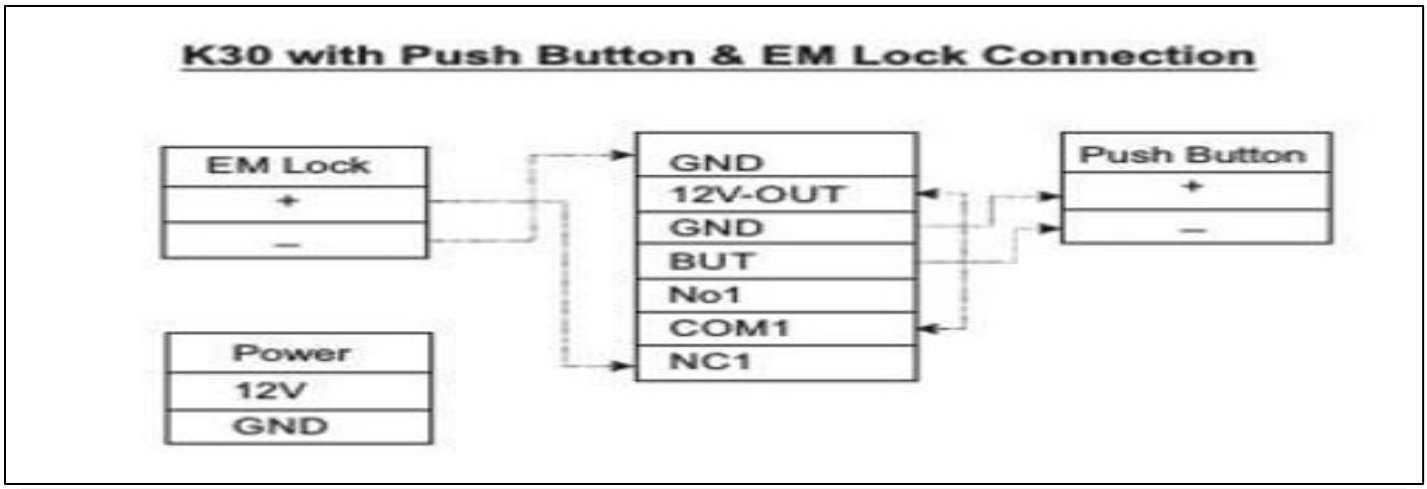


Fig 4: Connection Diagram of Detection & Counting of Fake Currency & Genuine Currency Using Image Processing

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2080

- **Receiver Module (ESP32 Dev Kit C V2):** This microcontroller is the main processing unit. It likely captures images from a camera, preprocesses the image data, performs machine learning inference to classify the currency as fake or genuine, and transmits the results wirelessly (if Bluetooth Low Energy (BLE) capabilities are used).
- **Relay Module:** This module is likely used to control an external device based on the classification results. For instance, it could activate a mechanism to reject fake currency or sort genuine currency into a separate bin.
- **Power Module (5V):** This component supplies power to all the other parts of the system.
- **LCD Display with I2C:** This display shows information about the system's operation, such as the number of genuine and fake currencies detected.



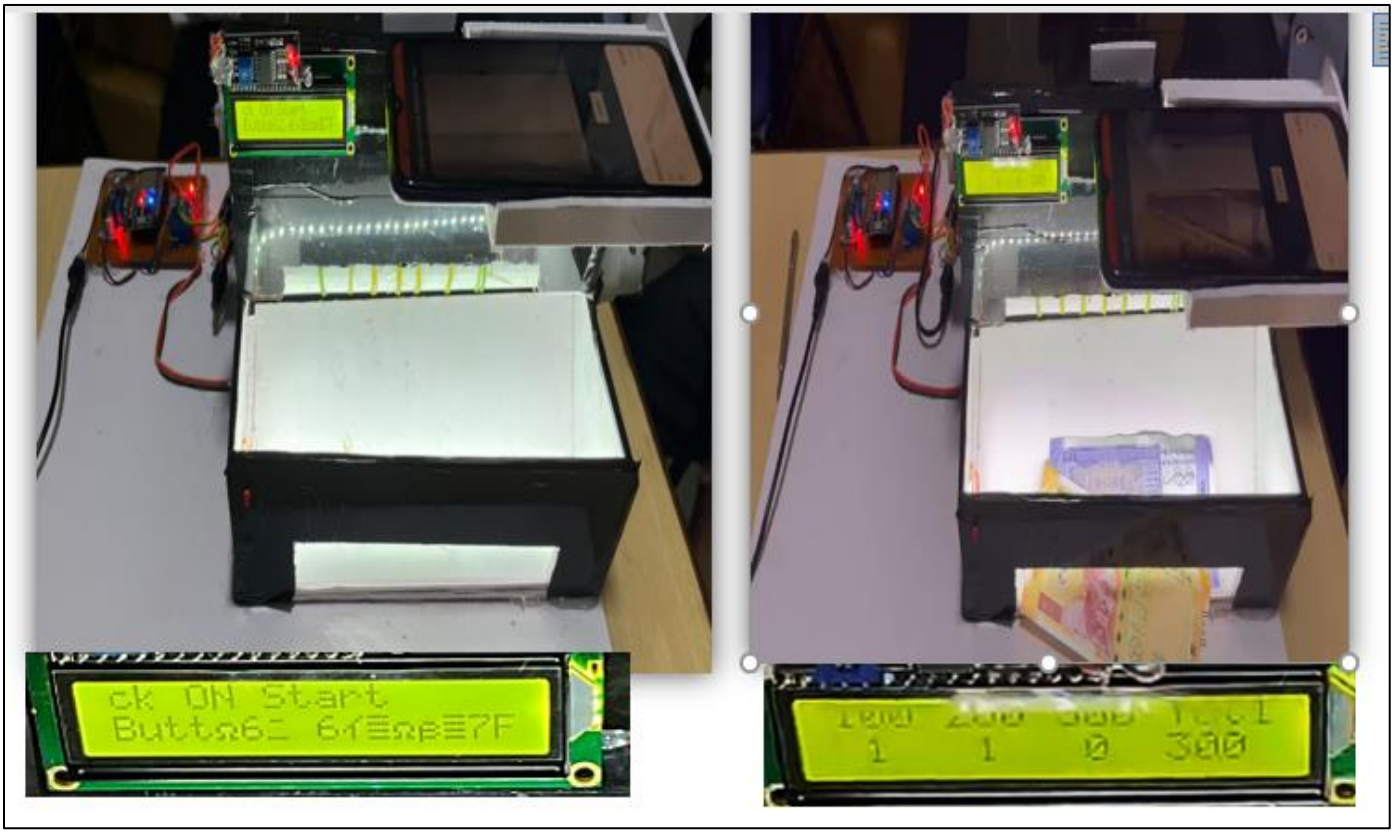


Fig 5: Real Image of the Detection & Counting of Fake Currency & Genuine Currency Using Image Processing

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2080

C. Advantages

- **Accessibility**: Leverages a widely available smartphone (Android) for currency detection, potentially reducing reliance on specialized hardware.
- **Machine Learning Power**: Integrates TensorFlow, a powerful framework, for accurate real-time classification of genuine and fake notes.
- **User-Friendly Interface**: Provides a user-friendly Android app for initiating and monitoring the detection process.
- **Portability**: The system's reliance on a phone and potentially wireless communication makes it portable and convenient for on-the-go use.
- **Real-Time Feedback**: Delivers real-time feedback on the authenticity of each dispensed note, allowing for immediate action if a fake is detected.
- **Visual Cues:** Utilizes an LED indicator for visual confirmation of the detection Result.
- **Potential Cost-Effectiveness:** By leveraging existing smartphone hardware, the overall system cost might be lower compared to dedicated currency detection **machines.**

D. Applications

- Banking and Financial Institutions
- ATM Machines
- Vending Machines
- Teller Operations
- Cash Registers
- Ticket Sales
- Online Sellers
- Airport Kiosks
- Transaction Verification
- Educational Events
- Central Banks
- School & Colleges

IV. CONCLUSION

A project focused on the detection of fake currency and counting of currency is a valuable endeavor with significant benefits, especially in the context of financial institutions, retail businesses, and currency exchange offices. Such projects typically involve a combination of hardware components, software algorithms, and security features to ensure accurate and reliable results. The key advantages include improved accuracy, efficiency, counterfeit detection capabilities, and user convenience. Currency counting and counterfeit detection systems play a crucial role in streamlining financial processes, reducing the risk of financial losses due to counterfeit currency, and enhancing overall security.

REFERENCES

[1]. FAKE CURRENCY DETECTION , Pallavi S*1, Pooja N*2, Yashaswini HR*3, Varsha N*4 , June-2022
[2]. Reserve Bank of India, High Level RBI Group Suggests Steps to Check Menace of Fake Notes, Press release 2009-2010, Dated 11 August (2009) , Sabeeta Badkar
[3]. Image-Based Processing of Paper Currency Recognition and Fake Identification: A Review Sabat Salih Muhamad , Twana Nasih Ahmed (2018) https://www.techniumscience.com/
[4]. Android-Based Verification System for Banknotes Ubaid Ur Rahman 1 , Allah Bux Sargano 2, ID and Usama Ijaz Bajwa 2 , Published: 24 November 2017
[5]. Machine Assisted Authentication of Paper Currency: an Experiment on Indian Banknotes Ankush Roy , Biswajit Halder, Utpal Garain, David S. Doermann, arXiv:1401.0689v1 [cs.CV] 2 Jan 2014
[6]. Fake Currency Detection Using Image Processing Ankur Saxena1 ,Pawan Kumar Singh2 , Ganesh Prasad Pal3 , Ravi Kumar Tewari (International Journal of Engineering & Technology) January 2018
[7]. A Neural Network-Based Model for Paper Currency Recognition and Verification Angelo Frosini, Marco Gori, Member, IEEE, and Paolo Priami, 1996
[8]. Fake currency detection using image processing Tushar Agasti, Gajanan Burand, Pratik Wade and P Chitra School of Electronics Engineering, VIT University , 14th ICSET-2017
[9]. M. Thakur and A. Kaur, "VARIOUS FAKE CURRENCY DETECTION TECHNIQUES," Published year :- 2014
[10]. Aoba, M., Kikuchi, T., Takefuji, Y.: Euro banknote recognition system using a three-layered perceptron and RBF networks. IPSJ Trans. Math. Model. Appl. 44, 99--109 (2003)
[11]. An automatic recognition of fake Indian paper currency note using MATLAB Binod Prasad Yadav, C. S. Patil, R. R. Karhe, P.H Patil ,Jully 2014
[12]. An automatic recognition of fake Indian paper currency note using MATLAB Binod Prasad Yadav, C. S. Patil, R. R. Karhe, P.H Patil ,Jully 2