

AUTOMATED NOTES TO COIN EXCHANGER

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INTRODUCTION

Image processing has become an important incitement for increasing the degree of automation in production processes. It is now indispensable in quality control and product identification as well as in process management and monitoring. Only with the help of modern image processing systems it is possible to realize today's requirements in terms of traceability, quality, cycle time and safety.

The idea of notes to coins exchanger based on image processing emerged to give a solution to the problems facing by vendors and customers in daily transactions at places like buses, railway stations and shops. The major problem to be handled by implementing this automated system is reduce the chaos without coins. The objectives of the project are to develop an accurate note recognition system using image processing techniques, build up an algorithm and to build a mechanical coin dispensing unit.

Though there are systems to identify currency notes like automated cash depositing machines and coin dispensers in coin operated vending machines and public phones the newly designed system provides much better convenience by integrating note identification and coin dispensing.

With implementing this system different types of image processing techniques which are used for Sri Lankan banknotes identification were tested using Matlab® image processing environment. Plenty of deviations observed in banknotes with their circulation and some of them were difficult to recognize due to their distortions and unnecessary damages made to notes. Optimal results were obtained based on the neural network based algorithm.

METHODOLOGY

The designed system comprise of following sub units.

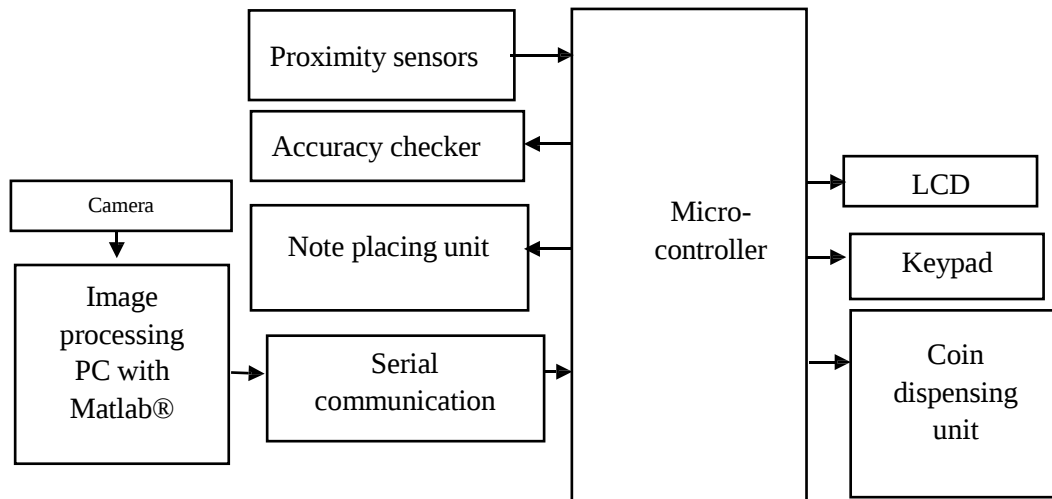


Figure 1. System block diagram

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The notes inserting unit consists of a stepper motor, IR proximity sensor, UV ray sensor for note detection and HD camera and note collecting bin. Note identification unit consists with a computer with image acquiring and processing system which is based on a Matlab® algorithm and a neural network based character recognition system to identify Sri Lankan bank notes. The coins dispensing unit which has four stepper motors for rotating coin ejecting disks and four coins stacks to store Rs.1, Rs.2, Rs.5 and Rs.10 coins. Further it has a LCD display to see the transaction process progress and DTMF keypad for acquiring information from the consumer.

OPERATION OF THE SYSTEM

Outlined operation of this system initiated with placing any Rs20, Rs50, Rs100 Sri Lankan bank notes properly in the note placing bin. Then the system will check it and then it will be subjected to a fake note checking process. After that image processing will be done in the same position and if the recognition process is success, denomination of the note will be sent to the PIC microcontroller and dispense the particular amount of coins accordingly and prepare for the next transaction.

Here the machine accepts note and checks whether a note is fake or real. This can be done by analyzing the UV absorption characteristics of currency notes. Fake note detection unit consist of UV LED, photodiode, amplifier and comparator. If the case is counterfeit, it is rejected out else, a note is real, camera takes picture of note and with help of computer having MATLAB® program checks the value of the note by series of techniques and accurate value will be sent to the microcontroller, thereby using LCD display user will be notified the denomination of the note and will be asked for the coin selection. Once the user gives the choice, system will check the amount of coins that system currently having and if the user's selection is possible again gives a notification via display that transaction can be completed and ask for confirmation. After confirmation system will issue coins by activating the coin dispenser unit. When user go away from the machine system will automatically check this using proximity sensors and go back to the low power state.

FINAL PRODUCT

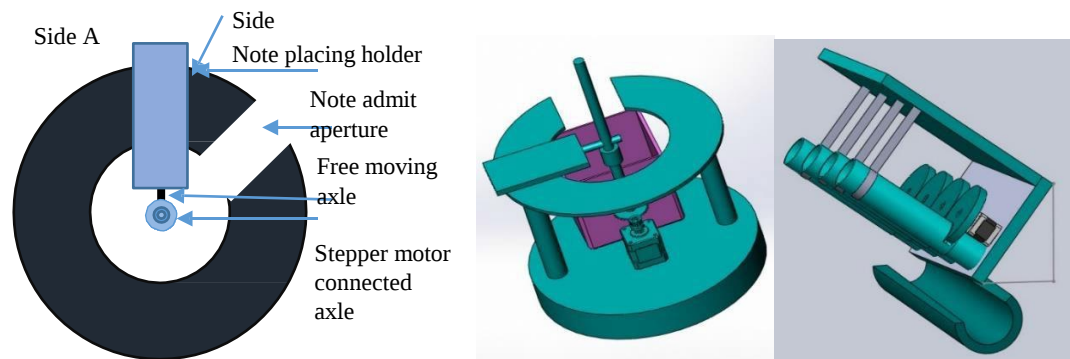


Figure 3. The designed note inserting unit and coin dispensing unit



Figure 4. Note inserting unit and coin dispensing unit

RESULTS AND DISCUSSION

The system was tested for several Sri Lankan currency notes. The percentage error in detecting the note is listed in the following table. For the accuracy testing 100 notes of each type is used.

Table 1. Test results for samples bank notes

Note type	Tested no of notes	Correctly recognized	Incorrectly recognized	Error percentage
Rs 100	100	96	4	4%
Rs 50	100	89	11	11%
Rs 20	100	86	14	14%

With the above test results the error percentage is below 14 %. To increase the accuracy the lighting condition inside the note identification unit must be kept constant.

CONCLUSION

As in the Sri Lankan market there is no any available similar systems the design is unique. Further it is totally designed to match with Sri Lankan currency notes.

Note to coins exchange system can be used to assist people to minimize the lack of coins problem. Hence for saving significant amount of money and time of the consumers. The emergence of new system like this makes the transaction processes faster and efficient. Clear banknote recognition was successful and relevant combination of coins were obtained as per the selection. This accommodate an excellent learning experience and it was discovered that this type of project would be a useful and important, valuable design for students interested in both electronic and mechanical applications.

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