Enhanced Ration Distribution System using RFID and Finger-Vein Recognition

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Abstract

In recent technologies, biometrics plays an important role for authentication in various applications. There are many biometric methods available for authentication; the finger vein will be highly reliable for personal identification. In current scenario, we are in need of high security identification due to high level of forgery. Here, we have proposed a new approach which uses finger vein as the key aspect for ration card authentication. It acts as address proof for various purposes etc. All the people having a ration card to buy the various materials (sugar, rice, oil, kerosene, etc.) from the ration shops. In this paper, proposed an Automatic Ration Materials Distribution Based on GSM (Global System for Mobile) and RFID (Radio Frequency Identification) technology instead of ration cards. To get the materials in ration shops need to show the RFID tag into the RFID reader, then controller check the customer codes and details of amounts in the card. After verification, these systems show the amount details. Then customer need to enter their required materials by using keyboard, after receiving materials controller send the information to government office and customer through GSM technology. In this system provides the materials automatically without help of humans.

Keywords: Finger-vein, Microcontroller, GSM, RFID, Motor, Solenoid Control Circuits, Mechanical Part.

1. Introduction

Public distribution system (PDS) is an Indian food security system. Established by the Government of India under Ministry of Consumer Affairs, Food, and Public Distribution and managed jointly with state governments in India, it distributes subsidized food and non-food items to India’s poor. This scheme was launched in India on June 1997. Major commodities distributed include staple food grains, such as wheat, rice, sugar, and kerosene, through a network of fair price shops (also known as ration shops) established in several states across the country. Food Corporation of India, a Government-owned corporation, procures and maintains the PDS.

In coverage and public expenditure, it is considered to be the most important food security network. However, the food grains supplied by the ration shops are not enough to meet the consumption needs of the poor or are of inferior quality. The average level of consumption of PDS grains in India is only 1 kg per person / month. The PDS
has been criticized for its urban bias and its failure to serve the poorer sections of the population effectively. The targeted PDS is costly and gives rise to much corruption in the process of extricating the poor from those who are less needy. Today, India has the largest stock of grain in the world besides China, the government spends Rs. 750 billion ($13.6 billion) per year, almost 1 percent of GDP, yet 21% remain undernourished. Distribution of food grains to poor people throughout the country is managed by state governments. As of date there are about 500,000 Fair Price Shops (FPS) across India.

2. Overview

The central and state governments shared the responsibility of regulating the PDS. While the central government is responsible for procurement, storage, transportation, and bulk allocation of food grains, state governments hold the responsibility for distributing the same to the consumers through the established network of Fair Price Shops (FPSs). State governments are also responsible for operational responsibilities including allocation and identification of families below poverty line, issue of ration cards, supervision and monitoring the functioning of FPS Under PDS scheme, each family below the poverty line is eligible for 35 kg of rice or wheat every month, while a household above the poverty line is entitled to 15 kg of food grain on a monthly basis.

A below poverty line (BPL) card holder should be given 35 kg of food grain and the card holder above the poverty line should be given 15 kg of food grain as per the norms of PDS. However, there are concerns about the efficiency of the distribution process.

3. System Overview

Framework of the proposed system:
System consists of three stages namely,
   a) Image acquisition
   b) Segmentation
   c) Feature extraction

3.1 Image Acquisition:

Image acquisition is defined as the act of retrieving an image from a source, usually a hardware-based source, which can be passed through whatever processes need to occur afterward. Image acquisition is the creation of photographic images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images.
Fig (a) explores, the person should place their finger in the sensor, which senses and captures the image of the finger vein. The person should place their finger in an exact position, otherwise the device will not detect the finger vein.

Fig (b) explains a clear view of the previous figure. When the finger is placed in between the LED and the image sensor, infra red light falls on the finger from the upper side at the same time the vein is sensed from the lower side by the image sensor. This image after that undergoes segmentation and feature extraction.

### 3.2 Image Segmentation

Image segmentation is a process which is typically used to locate objects and boundaries in images. In order to perform segmentation edge detection masks are found using gradient operator.

After the edge detection mask is obtained boundaries are set to find the region of interest and to segment the image. Two boundaries namely the horizontal and the vertical boundary are set to 100 and 200 pixels respectively shown in fig(c).
3.3 Feature Extraction

LDP and LBP are used to extract the binary codes from the enhanced images. Although the performance of LDP is better than the LBP, the computation time for LDP is about 2.5 times slower than the LBP. Moreover, the code length for LDP is four times longer than the LBP. The computation time and template size are two important factors that need to be considered in designing a biometric system. To overcome the above-mentioned problems, the binary codes in this work are extracted from the enhanced images using a new texture descriptor called Local Binary Pattern (LBP). One of the benefits of LBP operator is that it can emphasize the change in image intensity such as vertices, edges and corners.

4. Proposed Methodology

Block Diagram
5. Hardware Description

5.1 MSP430:

MSP430 is a family of ultra-low-power microcontrollers consist of several devices featuring different sets of peripherals targeted for various applications. The architecture, combined with five low-power modes, is optimized to achieve extended battery life in portable measurement applications. The device features a powerful 16-bit RISC CPU, 16-bit registers, and constant generators that contribute to maximum code efficiency. The digitally controlled oscillator (DCO) allows wake-up from low-power modes to active mode in less than 1 µs.

The MSP430x21x1 series is an ultra-low-power mixed signal microcontroller with a built-in 16-bit timer, versatile analog comparator, and sixteen I/O pins. Typical applications include sensor systems that capture analog signals, convert them to digital values, and then process the data for display or for transmission to a host system. Stand-alone RF sensor front end is another area of application. The analog comparator provides slope A/D conversion capability.

5.2 RS232

An RS-232 port was once a standard feature of a personal computer for connections to modems, printers, mice, data storage, un-interruptible power supplies, and other peripheral devices. However, the limited transmission speed, relatively large voltage swing, and large standard connectors motivated development of the universal serial bus which has displaced RS-232 from most of its peripheral interface roles. Many modern personal computers have no RS-232 ports and must use an external converter to connect to older peripherals. Some RS-232 devices are still found especially in industrial machines or scientific instruments.

5.3 GSM Module

GSM is a digital mobile telephony system. GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band. The GSM module is communicate the microcontroller with mobile phones through UART. To communicate over UART or USART, we just need three basic signals which are namely, RXD (receive), TXD
(transmit), GND (common ground). GSM modem interfacing with microcontroller for SMS control of industrial equipments. The sending SMS through GSM modem when interfaced with microcontroller or PC is much simpler as compared with sending SMS through UART.

Text message may be sent through the modem by interfacing only three signals of the serial interface of modem with microcontroller i.e., TxD, RxD and GND. In this scheme RTS and CTS signals of serial port interface of GSM Modem are connected with each other. The transmit signal of serial port of microcontroller is connected with transmit signal (TxD) of the serial interface of GSM Modem while receive signal of microcontroller serial port is connected with receive signal (RxD) of serial interface of GSM Modem. The SMS message in text mode can contain only 140 characters at the most.

5.4 RFID

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC)

5.5 Stepper Motor

A stepper motor is a brushless, synchronous electric motor that converts digital pulses into mechanical shaft rotation. Every revolution of the stepper motor is divided into a discrete number of steps, and the motor must be sent a separate pulse for each step. The stepper motor is connected with Microcontroller output port pins through a ULN2803A array. So when the microcontroller is giving pulses with particular frequency to ULN2803A, the
motor is rotated in clockwise or anticlockwise. The LPC2148 Slicker board has four numbers of I/O port lines, connected with I/O Port lines (P1.16 – P1.19) to rotate the stepper motor. ULN2803 is used as a driver for port I/O lines, drivers output connected to stepper motor, connector provided for external power supply if needed. Stepper Motor can connect JP17 or J6 connector.

5.6 Relay

Relays are devices which allow low power circuits to switch a relatively high Current/Voltage ON/OFF. A relay circuit is typically a smaller switch or device which drives (opens/closes) an electric switch that is capable of carrying much larger current amounts. There are 2 input channels. Each input is connected to the triggering coil of the respective relay. There are 2 output channels that each correspond to an input. When the input is energized, the relay turns on and the ‘+’ output is connected to +12v. When the relay is off, the ‘+’ output is connected to Ground. The ‘-’ output is permanently wired to Ground.

5.7 Load Cell

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The various types of load cells include hydraulic load cells, pneumatic load cells and strain gauge load cells.

This wide bar load cell (sometimes called a strain gauge) can translate up to 10kg of pressure (force) into an electrical signal. Each load cell is able to measure the electrical resistance that changes in response to, and proportional of, the strain (e.g. pressure or force) applied to the bar. With this gauge you will be able to tell just how heavy an object is, if an object’s weight changes over time, or if you simply need to sense the presence of an object by measuring strain or load applied to a surface.
6. Working:

First user’s select the correct finger Vein image and smart card Image with the help of MATLAB. Here we use the MATLAB for the authentication purpose. At this time Fig. d explains the basic module of Finger Vein input Detection.

After the Successful verification PC will communicate with Msp430 and also PC will give the Users Details and also they show the currently available stock details. In the hardware setup they are mainly consider some important hardware’s. that’s are RS232 for communicating PC and Hardware, Microcontroller for controlling the Hardware and also provide the Accurate output, Keypad for selecting the Materials, GSM for communicate Ration shop and Government head Office. This machine mainly used to calculate the weight of the materials. After Verifying users Details, PC will send the available purchasing stock details to the Microcontroller. With the help of Keypad user’s will select the stock Details. If user wants to Rice means they enter 1 in Keypad.

Then stepper Motor Automatically Rotate in Clock wise and distribute the Rice. After current quantity of Materials Distribution, the stepper Motor will be automatically stop with the help of IR sensor for avoiding the Wastage of Materials. Suppose if user selects Sugar means the Stepper Motor will be Rotate in Anti Clockwise and distribute the sugar. If user’s wants oil items means they select 3 with the help of keypad. Then solenoid valve will be automatically open and distribute the oil items. Here Liquid Level sensor is used to identify the flow and the level of liquids in a particular container for avoiding the Wastage.

7. Advantages of the Proposed System

- By implementing privacy preserving technology in the proposed system, it gives us the privacy for role based access to the system i.e. end user, distributor and governmental offices.
- This system is more efficient as all resources and transactions become transparent.
- Management of resources and transaction becomes more easy and feasible.
- It solves many social conflicts i.e. illegal usage, over population, smuggling of food by providing transparency in the distribution of the food grain.
- It becomes very easy to handle all the records of the transactions held in the ration shop between end users and distributor, distributor and government and vice versa as all records made available online and only top level government can access it, any person from the registered people can access it and reduces conflicts.

8. Result Discussion

Finally Microcontroller will be Interface with GSM for communicate both user’s and Government Head office. After the successful materials Distribution, Shop workers will be intimate the currently available
stock details and also distribution details to the individual user’s as well as government head office.

Fig. d) Finger Vein Input Detection

Fig: e) Details Verification

9. Conclusion

This paper presents a new effective biometric to provide authentication for ration card by the key factor finger vein. Finger vein authentication will be effective when comparing with other biometrics. Forgery is not possible with finger vein, as it differs for every individual. This will blackout the duplicate ration cards and duplicate authentication. It also cannot pay way to the PDS shop owners who is selling the subsidized foods and goods in the black market. Vein scanning cannot be done without the knowledge of a person because scanning of vein can only be done with exact positioning of the finger. The only limitation in this method is, that the cost of the image capturing device which is used in this proposed system is expensive which itself becomes an advantage for reducing the rate of forgery, because the person who performs forgery also needs appropriate expensive devices to carryout
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