A Study on Applications of Microprocessor and Microcontroller

Priyanka P[1], Rajesh K M[2]
[1]Assistant Professor, Dept. of Electronics and Communication, GSSSIETW, Mysuru, Karnataka, India
[2]Assistant Professor, Dept. of Telecommunication,GSSSIETW, Mysuru, Karnataka, India

Abstract- **Microprocessors are applicable to a wide range of information processing tasks, ranging from general computing to real-time monitoring systems. The microprocessor facilitates new ways of communication and how to make use of the vast information available online and offline both at home and in workplace. Electric Utilities Company have traditionally used electromechanical (EMR) distance relays for the protection of transmission lines in the past, and many such relays are still in use in power systems today. Microprocessor-based protective relays (MPBRs) applications in the power systems protection were investigated. The overall scheme takes up less panel space, the design and wiring is simpler and less costly to implement. Installation and maintenance testing are greatly reduced. ATM is one such machine which made money transactions easy for customers to bank. Face recognition techniques are using in the banking sector and also private offices like companies verify the originality of the user identify and only particular user is allowed to use the SIM ID based automatic teller machine.**

Index Terms- **EMS; Relays; ARM; STA; SIM.**

INTRODUCTION

A microprocessor is usually a silicon chip that contains millions of transistors and other components that process millions of instructions per second integrated with memory chips and other special purpose chips, and directed by software. It is a multipurpose, programmable microchip that uses digital data as input and provides results as an output once it processes the input according to instructions stored in its memory. Microprocessors use sequential digital logic as they have internal memory and operate on numbers and symbols represented in the binary numeral system. They are designed to perform arithmetic and logic operations that make use of data on the chip. General purpose microprocessors in PCs are used for multimedia display, computation, text editing and communication. Several microprocessors are part of embedded systems. These embedded microprocessors provide digital control to several objects including appliances, automobiles, mobile phones and industrial process control.

Microprocessor-based relays (MPBRs) offer many advantages over schemes using discrete components. The overall scheme takes up less panel space. The number of components is greatly reduced. The design and wiring is simpler and less costly to implement. Installation and maintenance testing can be greatly reduced. MPBRs offer many advanced features and functions in addition to their basic protection functions, for instance, fault locating, event reporting, and self-checking. The added benefits of simple scheme design and improved reliability make them a very attractive option. The relay implements more flexible protection schemes, reduce maintenance, and obtain more information to increase understanding of the power system, and improve their liability of the protection system as a whole at a cost less than conventional electromechanical relays.

The rise of technology in India has brought into force many types of equipment that aim at more customer satisfaction. ATM is one such machine which made money transactions easy for customers to bank. The other side of this improvement is the enhancement of the culprit's probability to get his 'unauthentic' share. Traditionally, security is handled by the combination of a physical access card and a PIN or other password in order to access a customer's account. This model invites fraudulent attempts through stolen cards, badly-chosen or automatically assigned PINs, cards with little or no encryption schemes, employees with access to non-encrypted customer account information and other points of failure.

By forcing the ATM to match a live image of a customer's face with an image stored in a bank database that is associated with the account number, the damage to be caused by stolen cards and PINs is effectively neutralized. Only when the PIN matches the account and the live image and stored image match would a user be considered fully verified.

The main issues faced in developing such a model are keeping the time elapsed in the verification process to a negligible amount, allowing for an appropriate level of variation in a customer's face when compared to the database image, and that credit cards which can be used at ATMs to withdraw funds are generally issued by institutions that do not have in-person contact with the customer, and hence no opportunity to acquire a photo.

In the case of credit card use at ATMs, such a verification system would not currently be feasible without creating an overhaul for the entire credit card issuing industry, but it is possible that positive results (read: significant fraud reduction) achieved by this system might motivate such an overhaul.

When a match is made with the PIN but not the images, the bank could limit transactions in a manner agreed upon by the customer when the account was opened, and could store the image of the user for later examination by bank officials. In regards to bank employees gaining access to customer PINs for use in fraudulent transactions, this system would likewise reduce that threat to exposure to the low limit imposed by the bank and agreed to by the customer on visually unverifiable transactions.

The last consideration is that consumers may be wary of the privacy concerns raised by maintaining images of customers in a bank database, encrypted or otherwise, due to possible hacking attempts or employee misuse. However, one could argue that having the image compromised by a third party would have far less dire consequences than the account information itself. Furthermore, since nearly all ATMs videotape customers engaging in transactions, it is no broad leap to realize that banks already build an archive of their customer images, even if they are not necessarily grouped with account information.

MICROPROCESSOR

A microprocessor is also known as a central processing unit (CPU), which is a complete computing engine assembled on a single chip. It performs all the computational tasks, calculations and data processing of the computer. The most popular type of microprocessor is the Intel Pentium chip. A typical example is shown in Figure 1.

Figure 1: Intel 4004 microprocessor.

Microprocessors may be classified by their hardware architecture. The two basic types of hardware are complex instruction set computer (CISC), and reduced instruction set computer (RISC).

Applications such as DVD players, cellular telephones, household appliances, car equipment, toys, light switches and dimmers, electrical circuit breakers, smoke alarms, battery packs, car keys, power tool and test instruments use microprocessors. Pollution control standards require automobile manufacturers to use microprocessor engine management systems for an optimal control of emissions over varying operating conditions. A typical microprocessor makes daily life easier because of its vast application in every field.

The applications of microprocessors to life include but not limited to the following:

1. Household Devices.
2. Industrial Applications of Microprocessors.
3. Transportation Industry
4. Computers and Electronics
5. Low-Power and Battery Management
6. In Medicals
7. Imaging Applications.
8. Communication.
9. Deep Cover Security Systems.
10. Automatic Process Control.

Microprocessor-Based Protective Relays

ELECTROMECHANICAL RELAYS

This Electric power utilities in power systems have traditionally used electromechanical (EMR) distance relays for the protection of transmission lines in the past, and many such relays are still in use in power systems today. These relays worked based on

creating a mechanical force to operate the relay contacts in response to a fault situation. The mechanical force is established by the flow of a current that reflected the fault current through windings mounted in magnetic cores.

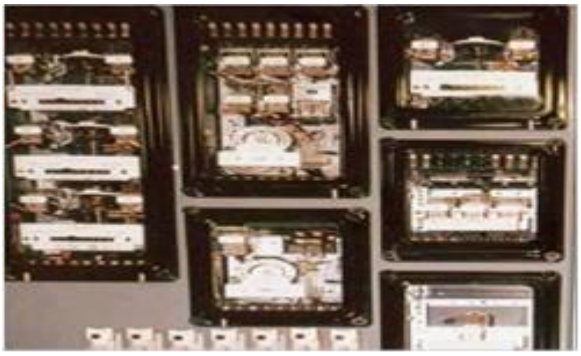


Figure 2: Typical Electromechanical Relay Scheme Panel

The size and complexity of modern power transmission and distribution systems, as well as the recent advances in digital computing, and protection relays technologies have made the manual operation of the relay settings impracticable. These relays have the following limitations;

- Low speed of operation, single function characteristic curve, and component failure leading to relay failure.
- Excessive power consumption, Imposes high burden on instrument transformers.
- No fault data available except phase indication.

MICROPROCESSOR-BASED RELAYS

Microprocessor-based relays incorporated analog-to-digital converter (ADC) to sample the analog signals incoming from instrument transformers, and used microprocessor to define the logic of the relay. These relays feature advanced programmable functions which maximize flexibility and monitoring capabilities, and offer a wide choice of characteristics curves. It replaces most of the electronic circuitry; thereby maximizing integration of advanced protection functions, fault location, event recording, control and monitoring, alarm and annunciation, metering and communication into a single device.

The main advantages of microprocessor relays over electromechanical relays are their reliability, functional flexibility, self-checking and self-adaptability. Microprocessor relays are able to implement more complex functions, be more accurate and be immune from physical environment effects. It reduces maintenance costs by providing self-test functions and high reliability, provides remote targets, metering data memory capabilities, fault location and status information to assist operations in restoration of electrical service, in addition to protection functions. Additional features commonly available on microprocessor-based relays are sequence of Event recorders (SER), Disturbance Recorders (DR), measurement functions and power quality monitoring (PQM). The relay also uses sophisticated communication for signaling other remote relays.

SPACE REQUIREMENTS OF HARDWARE

A typical three-zone step time distance scheme consists of instantaneous tripping elements, two levels of time-delayed tripping elements for phase faults and an instantaneous tripping element, and time over current element for ground faults. For this example, we shall assume that the step time distance scheme uses phase distance and directional ground over current elements. Phase faults are detected using three zones of phase distance relays. Ground faults are detected using a directional ground over current relay which includes a time over current element and an instantaneous over current element.

Figure 3: Typical microprocessor-based relay scheme panel

A Combination of electromechanical and microprocessor-based relays scheme panel is shown in Figure above. The electromechanical scheme requires nearly all of the space contained in a 213cm by 48cm panel. The microprocessor-based scheme consists of a multifunction relay that provides three

zones of step time distance protection, three levels of instantaneous or definite time directional ground over current protection, a directional ground time over current function, and three-shot re closer. The microprocessor-based scheme also includes a single zone microprocessor-based relay as a backup in case of failure of the primary multi-zone relay. The space requirement for the microprocessor-based relay scheme is much less than the electromechanical relay scheme.

MICROCONTROLLERS

Microcontrollers are designed for industrial control applications, where ease of use and versatility rather than speed is the main requirements. They interface with sensors and other devices in applications ranging from on-board computers in cars to lighting systems and renewable energy control systems.

Input/output and memory functions are often embedded along with the core processing functions on one chip. In addition to Intel, Free scale, Micron and Texas Instruments are major manufacturers of microcontrollers. When the most modern technical engineering is applied to a microcontroller it allows the device to be extremely compact, making microcontrollers popular within mobile devices such as cell phones and PDAs.

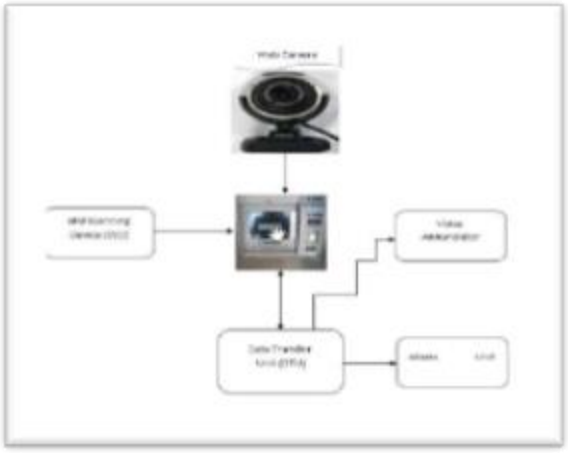
To the layperson, microcontrollers and microprocessors may seem like very different devices; however, it is important to note that all microcontrollers contain microprocessors. The major difference between a microcontroller and a multifunctional PC microprocessor is the overall level of complexity. Microcontroller processors are designed to fill a smaller, more focused variety of roles while making use of less expensive and less complex circuitry. The main advantage of a microcontroller is that it allows electronic automation in situations where a full-sized computer is not needed. Microcontrollers integrate a microprocessor with peripheral devices for control of embedded system (computer system designed for specific control functions within a larger system, often with real-time computing constraints). Embedded systems range from portable devices such as digital watches, and MP3 players, to large stationary installations like traffic lights, and factory controllers.

In real-time computing systems, microprocessors are embedded in security devices such as the anti-lock braking system (ABS) that are widely used in modern automobiles. The microprocessor detects motions and changes, that are relative to the surrounding or environment of the security device and sends signals that correspond to the changes that it detected. Microcontrollers have innumerable applications. Some examples of their simple applications are in:

1. Biomedical instruments like an ECG LCD display cum recorder, blood cell recorder cum analyzer, patient monitor system.
2. Communication systems like numeric pagers, cellular phones, cable TV terminals, FAX and transceivers with or without an accelerator, video game and so on.
3. Peripheral controllers of a computer such as the keyboard controller, printer controller, laser printer controller, LAN controller and disk drive controller.
4. Instruments such as an industrial process controller, and electronic smart weight display system.
5. A target tracker.
6. An automatic signal tracker.
7. Accurate control of the speed and position of a DC motor.
8. A robotics system. Automotive applications like a close loop engine control, a dynamic ride control, an anti-lock braking system monitor and so on.
9. Electronic data acquisition and supervisory control system, the industrial moisture recorder cum controller, CRT display controller, digital storage system and spectrum analyzer.

Face recognition technology for ATM

One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information. GSM networks are most popular and widespread wireless communication media across the world, having a wide customer base in Europe and Asia-Pacific and command more than 50 percent of mobile customers. The advancement of GSM networks increases rapid growth of its users and services. Being an advance technology it becomes favourites for the criminals. These things created worldwide market for the analysis and monitoring of GSM network.



1) SIM Scanning Device

Scanning device consist of GSM MODEM which acts like a scanner for tracking the SIM ID. This ID consists of user information from which controller verifies the originality of the user.

2) Web camera

Camera is used for Capturing the face image of the user hence by using suitable algorithm the match of images is performed by ARM controller.

3) Voice Annunciator

The voice annunciator produces the voice which enhances the user to make the transaction effortless.

4) Alarm unit

If the face which given as an input to the controller is mismatched with the data base images then unauthenticated mode is activated and ARM controller activated the alarm signal for alarm unit.

5) Data Transfer unit (DTU)

Data transfer unit transfer the user information from external world to the ARM controller. The information's are stored temporarily in this unit and it acts like mediator for effective function of all units such as providing input for voice annunciator and alarm unit.

Whenever the user enters the ATM room for rendering money the SIM Identity belonging to that customer is inserted in to the SIM scanning device(which here used is a GSM module).The scanning device then tracks the SIM information of the corresponding user. Then the Data Transfer Unit transfers the data to the ARM controller and controller searches for the desired customer Information on the database. If the information provided by the customer matches with the information present in the database then facial recognition process starts with the help of a Web Camera, if the facial image also matches with any one of the database stored images the customer is allowed for the money transaction with the help of voice annunciator. If the facial image does not match with any one of the customer stored images an automatic message regarding ATM access will be forwarded to the actual customer whether to permit the transaction or not. If the customer responds as 'Yes' then transaction continues with the help of voice annunciation unit, if the customer responds as 'No' then the user is treated as unauthorized and Alarm Unit continuously beeps. If the information provided by the customer from SIM ID is mismatched with database then data transfer unit signal the alarm unit to beep continuously and money transaction is banned.

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