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Design and Implementation of Secure Electronic Passport system

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ABSTRACT: The Electronic passport is the digital version of the paper passport to provide stronger identity authentication. Passport verification and checking which a very time consuming process. To be ease identity checks, lessen the amount of human errors, protect against manipulation of travel documents and improve border security issues hence, new passport turned out to be much more intrusive than the traditional one. The proposed system simplifies this process with RFID card where the unique identification number is stored which corresponds to the information of the person. The information includes the name, nationality, address etc. along with attach the copy of the required certificates required according to the application. The information is transferred to computer with the help of RF transceiver. It may also include some other features such as buzzer for audio visual indication and system to lock the door. This proposed system uses Radio Frequency Identification (RFID) is a technology that uses wireless communication for identification purposes. The key characteristic that differentiates one RFID application from another is the purpose of identification.

KEYWORDS: e-passport; RFID; digital password; paper passport; secure passport system

I. INTRODUCTION

An e-passport is a passport which features microchip technology. An integrated circuit (chip) within its pages contains the data that are essential in verifying the identity of the passport holder. These data include the personal data found on the data page of the passport, the biometrics of the passport holder, and the unique chip identification number [3]. Electronic passports have an integrated chip, generally embedded in the cover page of the document that contains personal information of the document owner. a contactless (or RFID) technology has been chosen for the inspection process . An e-passport, or a digital passport, is a combined paper and electronic passport that contains biometric information that can be used to authenticate the identity of travellers. It uses contactless smart card technology, including a microprocessor chip (computer chip) and antenna (for both power to the chip and communication) embedded in the front or back cover, or canter page, of the passport. Electronic passports include contactless chip which stores personal data of the passport holder, information about the passport and the issuing institution. In its simplest form an electronic passport contains just a collection of read-only files. The passport's critical information is both printed on the data page of the passport and stored in the chip [3]. Public Key Infrastructure (PKI) is used to authenticate the data stored electronically in the passport chip making it expensive and difficult to forge when all security mechanisms are fully and correctly implemented. The specific choice of each country as to biometric security features to include makes a major difference in the level of security and privacy protection [3].

In this the details of the person would be fed into the RFID cards (passports in RFID form). The RFID reader reads the details of the RFID passport and sends the data wirelessly with the help of RF transceiver. On the other side the other RF receiver receives the details and sends to the microcontroller. Here, the controllers compares with the data already there. If it matches than the person is allowed, less he would be termed as a criminal by giving an alarm/buzzing signal [3]. The e –passport with wireless contact on border control requires that any information is available without the holders consent. It can be realized on the basis of the access control procedure. The microchip is activated only by a code that is delivered from the machine readable zone –MRZ. Hence, only the holders give permission to access to the data stored inside of the chip.[1] While inclusion of the MRZ sped up passport processing, it did little to improve the document's inherent security. The practice of removing a passport holder's

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picture and replacing it with another, however, has garnered much attention as a potentially simple means of committing passport fraud [3].

II. RELATED WORK

In the globalization world we can observe electronic transactions of documents and advanced secure measures to authenticate persons, information, goods, etc [1]. The goal of e-passport is to provide strong authentication *through* documents that unequivocally identify their bearers. E-passport is a combined system of RFID and biometric technologies [1, 2]. The international community is debating policy and technologies regarding electronic approaches such as radio-frequency identification (RFID) devices. To facilitate travel, the twenty-seven member nations participating in the Visa Waiver Program (VWP) require standardized passport documents based on standards determined by the International Civil Aviation organization (ICAO) [3]. Fusion of RFID and biometrics technology is important in electronics passports, particularly for privacy considerations. Electronic passports have an integrated chip, generally embedded in the cover page of the document that contains personal information on the document owner.

The e-Passport contains an RF transponder, implemented as a contactless smart card, embedded in the cover of each passport. This transponder contains the information currently on the data page of the passport—name, birth date, country of citizenship, passport number, etc.—with the image of the passport holder stored as a JPEG file. The chosen technology is a passive International Organization for Standardization (ISO) & RF transponder with 64kB of on-board memory. Using an embedded electronic chip in the passport to store the information from the passport data page will enhance the security of the document and is expected to benefit travellers by improving the ability of border officials to verify personal identities. The Department plans to use this format because of the enhanced security features. The chip is passive and contains no power source, as it receives power from the RF fields produced by the reader [5]. The standard does not explicitly address the read range of the chip, but it is generally accepted that the read range will be a maximum of 4 inches (10cm) from reader to chip. Radio Frequency Identification (RFID) technology has existed for decades. The term RFID is generally used to describe any technology that uses radio signals for identification purposes which, in practice, "means any technology that transmits specific identifying numbers using radio." Today, new applications for RFID embed RF technology in common objects, or "everyday" things used by individuals, such as library books, payment tokens and government-issued identification [5]. The e-Passport bearers presents their document to a border security officer who scans the MRZ on the e-Passport through a MRZ reader and then places the e-Passport near an IS to fetch data from the e-Passport chip. Only when all the protocols are completed successfully, does the E- Passport release sensitive information such as secondary biometric identifiers. Extended Access Control ("EAC") is a mechanism specified to allow only authorized Inspection Systems (systems used to read e-passport) to read sensitive data from E-Passports. The e-Passport standard provides details about establishing a secure communication between an E-Passport and an Inspection System (IS), the authentication of an e-Passport, details on storage mechanisms and biometric identifiers that should be used. The digital photograph of the individual provides a facial biometric that can be used for automated identification processes by most implementations of the e-Passports by various countries have a single identifier only, the facial biometric. But the chip has sufficient capacity to include extensions, such as face, fingerprints and iris biometrics [7].

III. PROPOSED METHODOLOGY

The main functionality of this project is to access the passport details of a passport holder through RFID technology. For this purpose the authorized person is given an RFID card. This card contains an integrated circuit that is used for storing, processing information through modulating and demodulating of the radio frequency signal that is being transmitted. Thus, the data stored in this card is referred as the passport details of the person. The system architecture of the research work is shown in fig. 1. In this the details of the person would be fed into the computer and a unique number is allocated to the person that number is printed of RFID tag. The RFID reader reads the details of the RFID passport and sends the data wirelessly with the help of RF transceiver. On the other side the other RF receiver receives the details and sends to the microcontroller. Here, the controllers compares with the data already there. If it matches than the person is allowed, less he would be termed as a criminal by giving an alarm/buzzing signal.

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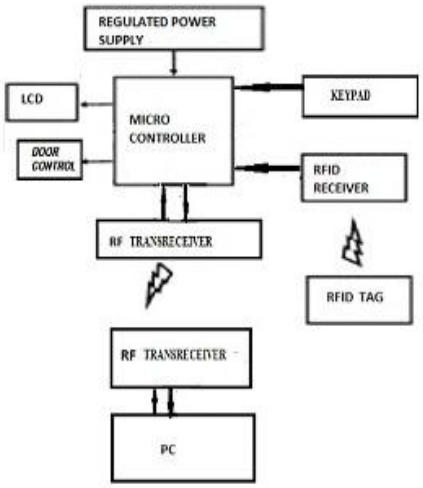

Fig 1: Architecture of Electronic Passport System

This proposed system simplifies the process by giving the authorized person an RFID tag containing all the passport details like name, passport number and nationality etc. Once, the person places the card in front of the RFID card reader, it reads the data and verifies it with that data present in the system and if it matches then it displays the details of the passport holder. Here we use microcontroller ATmega32. For display a 16X2 LCD is used. The LCD is used to display the basic messages such as "show tag", "enter your pin", "password matched" or "wrong password" etc. The door control is used to lock the door whenever the user is not authentic. The regulated power supply is used to supply power for the whole circuit. Here the keypad is used to press the keys; here each user is assigned a password the keys are used to press the assigned password.

A. Microcontroller

The controller used for this project is ATMEGA 32 processor. The processor performs following task such as receives data from RFID reader, conform the password of the each person which is given to him/her which is pressed with the help of keypad, perform all the necessary operations at the hardware circuitry such as giving messages to the LCD, send the data to the computer using the RF transceiver. Microcontroller acts as the most important component for the hardware circuitry. A program to control the necessary operation is fed into the microcontroller.

B. RFID tag and RFID Reader

RFID stands for Radio Frequency Identification Device. Here the person's unique identification number is stored in a passive RFID card and a person is identified with the help of this card and this card can be read with the help of the reader and hence, the RFID technology is used to identify the particular user.

C. RF Transceiver

The radio frequency transceiver is used to communicate between the hardware model and the computer. It acts as a wireless link between hardware model and the computer. It is a half duplex model i.e, it can communicate in both the direction but not simultaneously. It sends the received unique identification no to computer and to send weather to allow user or not.

D. Computer

Computer stores the person's information and display it in the form of a visual basic application. It includes information such as name, address and the scanned copies of the digital photograph and other document such as driving license and adhar card.

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E. LCD

The Liquid crystal display is used to display some basic massages such as “show tag” “enter password”etc. It is used to tell the user how to proceed further.

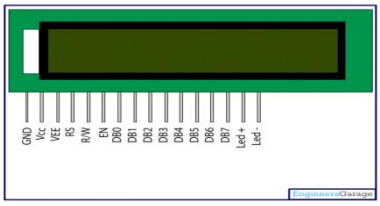

Fig. 2 LCD Display

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. In interfacing of LCD with ATmega32 using 4-bit mode. In this mode only four pins are used for sending data and command instructions. This mode has the advantage over the 8-bit mode as it uses less number of pins. The remaining pins of the controller are available for normal use.

F. Keypad

The keypad is nothing but switches which are used to press the assigned password. The password is given to improve the security in the person.

G. Door control

The door control consists of a DC motor and a driver IC L293D which is used to lock the user whenever required. DC Motors are small, inexpensive and powerful motors used widely in robotics for their small size and high energy out. A typical DC motor operates at speeds that are far too high speed to be useful, and torque that are far too low. Gear reduction is the standard method by which a motor is made useful. Gear’s reduced the speed of motor and increases the torque.

Fig. 3 DC Motor

It has two wires or pins. When connected with power supply the shaft rotates. You can reverse the direction of rotation by reversing the polarity of input. As the MCUs PORT are not powerful enough to drive DC motors directly so we need some kind of drivers. A very easy and safe is to use popular L293D chips. It is a 16 PIN chip. The pin configuration is shown in fig. 4.

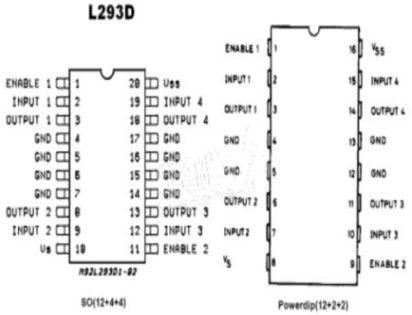

Fig. 4 Pin diagram of L293D

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This chip is designed to control 2 DC motors. Three pins are needed for interfacing a DC motor (A, B, Enable). If you want the o/p to be enabled completely then you can connect Enable to VCC and only 2 pins needed from controller to make the motor work. The connections are shown in fig. 5

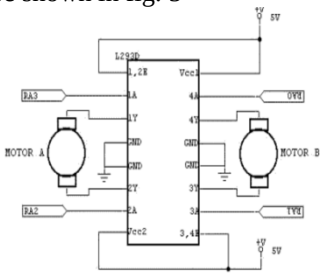

Fig. 5 DC Motor connection

The table-1 shows the direction of motor control with respect to the input given.

TABLE 1
Direction of rotation of motor according to input

Function	A	B
Stop	Low	Low
Clockwise	Low	High
Anticlockwise	High	Low
Stop	High	High

H-Bridge Circuit using transistors for bidirectional driving of DC motor. H-Bridges in IC's to reduce the drive circuit complexity.L293D is a dual H-Bridge motor driver, So with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion the you can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF output diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver.

H. MIKROC PRO

MikroC PRO for PIC is a full-featured ANSI C compiler for PIC devices from Microchip®. It is the best solution for developing code for PIC devices. It features intuitive IDE, powerful compiler with advanced optimizations, lots of hardware and software libraries, and additional tools that will helps in work. Compiler comes with comprehensive help file and lots of ready-to-use examples designed to get started in no time. Compiler license includes free upgrades and a product lifetime tech support, so you can rely on our help while developing. For developing or testing an embedded system application, a particular development cycle is followed which consists of several stages. An Integrated Development Environment (IDE) allows for implementation of all such steps of a development cycle. Typically, a development cycle has following steps; The code is written/edited in an Editor program, the Compiler/Assembler/Linker programs generate relevant support files like .hex, .obj, code is loaded into Simulator/Debugger program, code is analysed by Simulation or Debugging, If an error occurs, the code is re-edited and the whole cycle is repeated, following procedure can be used to make a project. Main project file that you select from mikroC using the Open project button: a) Open Project: Opening a project file; Menu: Project-->"Open Project..." b) Navigate to your stored files and select the .mcppi extension to load the project. c) Edit Project: If you want to change the project settings e.g. the chip type, oscillator frequency or other chip parameters then hit the 'Edit Project' button. Menu:Project-->"Edit Project..." d) Compile: Next hit the compile button; Menu: Build-->"Build" e) Success When the MikroC PIC C Compiler has completed its compilation the messages box at the bottom will show the compilation status (any errors in compilation are shown in red). When the compile finishes (and if successful) you should see the following window shown in fig. 6.

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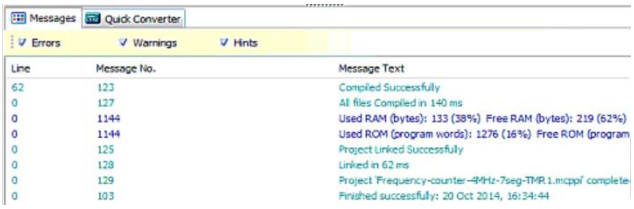

Fig. 6 Compilation Process in Mikro C

Now there should now be a lot more files in the original directory and the hex file will have been updated. MikroC is unusual in that it has a set of built-in libraries that you can use for many different peripherals. I tend to create the code myself as I like to know exactly how something works and this also has the advantage that you can use the code for a similar peripheral device and can get rid of bugs if you have any. However, if you are pushed for time, then the built in libraries provide a convenient way of speeding up the design process and include code support many different devices/concepts. To find the libraries Use the Menu:View-->"Library Manager" is shown in fig. 7.

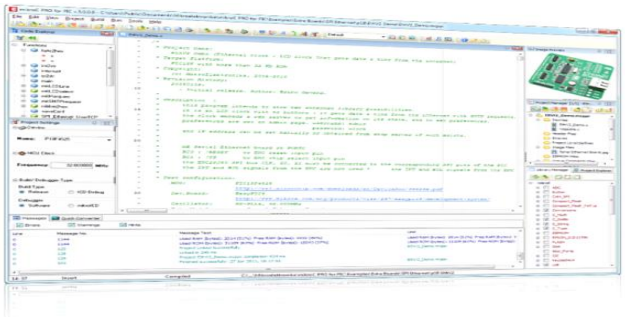

Fig. 7 Mikro c window

I. VISUAL BASIC

It's a computer programming system developed and owned by Microsoft. Visual Basic was originally created to make it easier to write programs for the Windows computer operating system. The basis of Visual Basic is an earlier programming language called BASIC (Beginners All-Purpose Symbolic Instruction Code) programming language, a language used by more programmers than any other language in the history of computing that was invented by Dartmouth College professors John Kemeny and Thomas Kurtz. Visual Basic is often referred to using just the initials; VB. Visual Basic is easily the most widely used computer programming system in the history of software. The application displays the name, address of the person it also include the scan copies of a digital photograph and documents such as adhar card, and driving license.

1. Creating an Application in Visual Basic

There are three main steps to creating an application in Visual Basic: Create the interface, set properties, and write code.

2. Creating a program

Design the interface, select controls from toolbox, place on form, size using mouse, Set properties of UI elements (controls).

3. Setting Properties

Properties are set using the properties window. The calculator display background colour is yellow. This was achieved by selecting the label object, selecting the property BackColor, dropping down the colour palette, and selecting the required colour cell is shown in fig. 8.

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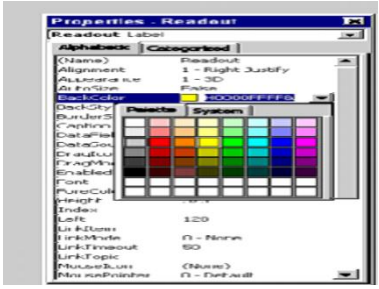

Fig. 8 Properties Window in VB

4. Writing program code

Code for the 'CE' command button (Cancel Entry) is shown in fig. 9.

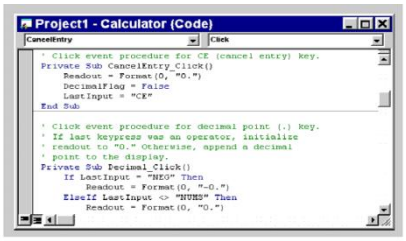

Fig. 9 Cancel Entry

IV. RESULT

Whenever traveller arrives at the airport he/she will have to swipe their RFID card in front of the RFID reader as shown in fig. 10 as below. The information stored in RFID card will be read by the card reader to check for authentic verification.

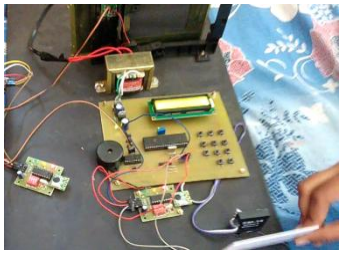

Fig. 10 RFID card reading

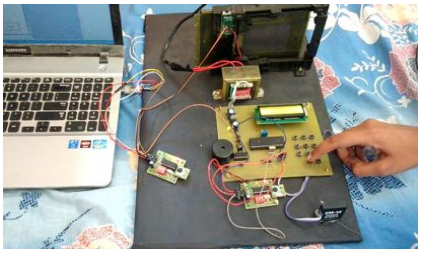

Fig. 11 Pressing password

When there is beep sound it indicates that the card is detected and now the user will have to enter the password shown in fig. 11. If the password entered is correct then, the details of that particular user will be display on the computer screen of the authorized person shown in fig. 12 also attached documents will be display on computer screen shown in fig. 13. Otherwise there will be long beep sound indicating that the password is wrong.

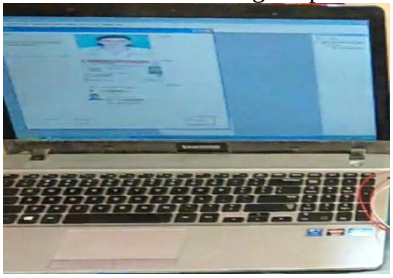

Fig. 12 Information displayed on screen

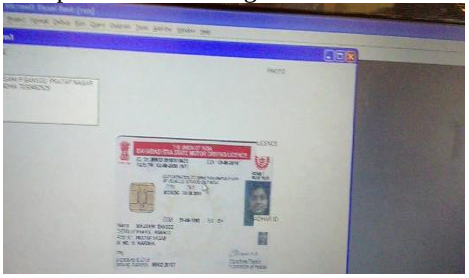

Fig. 13 Attached information document

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Now it's up to the security official weather to allow or to block the user and he can also view each document individually to verify document properly. If the person is allowed then the gate opens and if not audio visual indication will be given with the help of buzzer and gate will automatically close. The operation of gate open and close with gate motor is shown in fig. 14

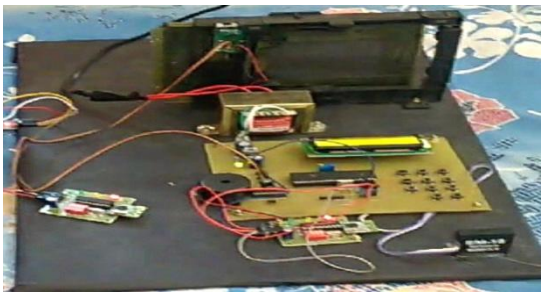

Fig. 14 Operation of Gate Motor

V. CONCLUSION

This project gives clear idea about the Electronic passport system which is much more beneficial for the airports and universities. It also reduces the burden of documentation as well as it reduces the time consumption. We analysed the major current and potential uses of RFID in identifying documents and the most important feature of this project is security, this will make the system centralized. The security of the system can be further increased by adding biometric information such as fingerprints, palm scan, iris scan, digital signature and other active authentication in the passport system.

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