Implementation of RFID based E-Voting System using PIC C Compiler and MATLAB software

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ABSTRCT

The project "RFID based E-Voting System" was designed an advanced e-voting system sing RFID and keypad with voter details instantaneously display on PC with MATLAB. Our project "Electronic Passport using RFID" is mainly intended to design an advanced E-voting system using RFID and keypad which helps in getting the voter details instantaneously using RFID technology. And using the keypad user can enter the relevant password when the voter tag and the password matches then the user details are displayed on PC using MATLAB software. The major features of this project are Data logging into PC using RS232 cable, MATLAB based image of authorized voter details display along with image, identification of voter through RFID communication and automatic display of voter details on LCD and on PC. The system also facilitates the voting data display when the election commissioner officer shows his tag and enters the password from keypad matches. The embedded C language provides effective environment in performing the task.

Keywords: RFID, PC, MATLAB, C language

INTRODUCTION

The project aims in designing an advanced E-voting system using RFID and keypad which helps in getting the voter details instantaneously using RFID technology. And using the keypad user can enter the relevant password when the voter tag and the password matches then the user details are displayed on PC using MATLAB software. This is very much helpful for the election officers to extract the details of the individual's person instantaneously and to identify nonregistered persons.Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. One among the technologies which had greater developments is RF communications. The result of this is the RFID cards which transmit a unique identification number. This number transmitted by the RFID can be read with the help of a RF reader. The main aim of this project is to extract voter ID registration details based on RFID technology like name, image, phone number, address, age, voter ID number etc. In this project the RFID tags are used for identifying the authorized person, and the RFID reader which is interfaced to microcontroller decodes the RFID tag of the voter individual details along with image and those authorized details are displayed on PC with MATLAB through RS232 cable.

The user initially needs to show the tag and need to enter the unique password from keypad when the voter tag and password matches then the system declares the individual as authorized. The authorized individual can vote the candidate from the keypad. The individual detail along with image gets displayed on PC with MATLAB and the received data will be fed to PC through a Microcontroller. When any voter ID is recognized as unauthorized then the system alerts through buzzer alarm. The system also facilitates the voting data display when the election commissioner officer shows his tag and enters the password from keypad matches. The Microcontroller is programmed using Embedded C language which provides effective environment in performing the task.An embedded system is software to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors. These are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. The project "RFID based E-Voting System" used to recognize the authorized voter individual using RFID and keypad when the user is identified then the details instantly displays on the PC MATLAB along with image his details using RFID technology.

METHODOLOGY

Embedded Systems:

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. In general, "embedded system" is not a strictly definable term, as most systems have some element of extensibility or programmability. A modern example of embedded system is shown in fig: 1.Labelled parts include microprocessor (4), RAM (6), flash memory (7).Embedded systems programming is not like normal PC programming. In many ways, programming for an embedded system is like programming PC 15 years ago. The hardware for the system is usually chosen to make the device as cheap as possible. Spending an extra dollar, a unit to make things easier to program can cost millions. Hiring a programmer for an extra month is cheap in comparison. This means the programmer must make do with slow processors and low memory, while at the same time battling a need for efficiency not seen in most PC applications. Below is a list of issues specific to the embedded field.

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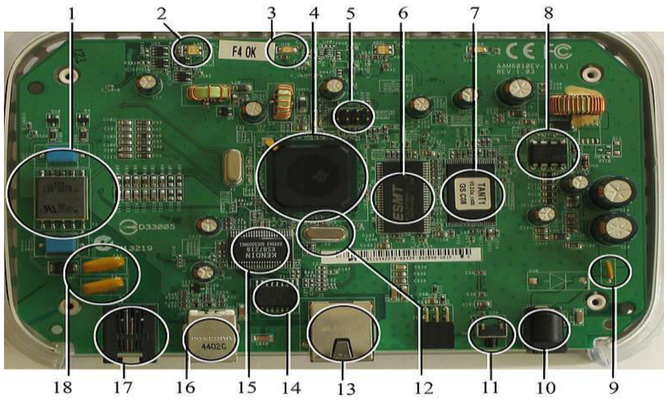

Fig 1:A modern example of embedded system

Need For Embedded Systems:

The uses of embedded systems are virtually limitless, because every day new products are introduced to the market that utilizes embedded computers in novel ways. In recent years, hardware such as microprocessors, microcontrollers, and FPGA chips have become much cheaper. So when implementing a new form of control, it's wiser to just buy the generic chip and write your own custom software for it. Producing a custom-made chip to handle a particular task or set of tasks costs far more time and money. Many embedded computers even come with extensive libraries, so that "writing your own software" becomes a very trivial task indeed. From an implementation viewpoint, there is a major difference between a computer and an embedded system. Embedded systems are often required to provide Real-Time response. The main elements that make embedded systems unique are its reliability and ease in debugging.

Software Architecture:

There are several different types of software architecture in common use.

- Simple Control Loop:In this design, the software simply has a loop. The loop callssubroutines, each of which manages a part of the hardware or software.

- Interrupt Controlled System:Some embedded systems are predominantly interrupt controlled. This means that tasks performed by the system are triggered by different kinds of events. An interrupt could be generated for example by a timer in a predefined frequency, or by a serial port controller receiving a byte. These kinds of systems are used if event handlers need low latency and the event handlers are short and simple.

- Cooperative Multitasking:A non-preemptive multitasking system is very similar to the simple control loop scheme, except that the loop is hidden in an API. The programmer defines a series of tasks, and each task gets its own environment to “run” in. When a task is idle, it calls an idle routine, usually called “pause”, “wait”, “yield”, “nop” (stands for no operation), etc. The advantages and disadvantages are very similar to the control loop, except that adding new software is easier, by simply writing a new task, or adding to the queue-interpreter.

- Primitive Multitasking:In this type of system, a low-level piece of code switches between tasks or threads based on a timer (connected to an interrupt). This is the level at which the system is generally considered to have an "operating system" kernel. Depending on how much functionality is required, it introduces more or less of the complexities of managing multiple tasks running conceptually in parallel.

- Microkernels and Exokernels:A microkernel is a logical step up from a real-time OS. The usual arrangement is that the operating system kernel allocates memory and switches the CPU to different threads of execution. User mode processes implement major functions such as file systems, network interfaces, etc.

Stand Alone Embedded System:

These systems takes the input in the form of electrical signals from transducers or commands from human beings such as pressing of a button etc.., process them and produces desired output. This entire process of taking input, processing it and giving output is done in standalone mode. Such embedded systems comes under stand-alone embedded systems

Eg: microwave oven, air conditioner etc...

Real-time embedded systems:

Embedded systems which are used to perform a specific task or operation in a specific time period those systems are called as real-time embedded systems. There are two types of real-time embedded systems.

Network communication embedded systems:

A wide range network interfacing communication is provided by using embedded systems.

Eg:

- Consider a web camera that is connected to the computer with internet can be used to spread communication like sending pictures, images, videos etc.., to another computer with internet connection throughout anywhere in the world.

- Consider a web camera that is connected at the door lock.

APPLICATIONS OF EMBEDDED SYSTEMS

Consumer applications: At home we use a number of embedded systems which include microwave oven, remote control, vcd players, dvd players, camera etc….

Office automation: We use systems like fax machine, modem, printer etc…

Industrial automation: Today a lot of industries are using embedded systems for process control. In industries we design the embedded systems to perform a specific operation like monitoring temperature, pressure, humidity ,voltage, current etc.., and basing on these monitored levels we do control other devices, we can send information to a centralized monitoring station.

Computer networking: Embedded systems are used as bridges routers etc..

Tele communications: Cell phones, web cameras etc.

This project is implemented using following software's:

- Express PCB – for designing circuit
- PIC C compiler - for compilation part
- Proteus 7 (Embedded C) – for simulation part

MATLAB software

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including graphical user interface building

MATLAB Desktop

When you start MATLAB, the MATLAB desktop appears, containing tools (graphical user interfaces) for managing files, variables, and applications associated with MATLAB. The first time MATLAB starts, the desktop appears as shown in the following illustration, although your Launch Pad may contain different entries. You can change the way your desktop looks by opening, closing, moving, and resizing the tools in it. You can also move tools outside of the desktop or return them back inside the desktop (docking). All the desktop tools provide common features such as context menus and keyboard shortcuts.

Desktop Tools

This section provides an introduction to MATLAB's desktop tools. You can also use MATLAB functions to perform most of the features found in the desktop tools. The tools are:

- Current Directory Browser
- Workspace Browser
- Array Editor
- Editor/Debugger
- Command Window
- Command History

- Launch Pad
- Help Browser

Manipulating Matrices

Entering Matrices

The best way for you to get started with MATLAB is to learn how to handle matrices. Start MATLAB and follow along with each example. You can enter matrices into MATLAB in several different ways:

- Enter an explicit list of elements.
- Load matrices from external data files.
- Generate matrices using built-in functions.
  Create matrices with your own functions in M-files.
  Start by entering Dürer's matrix as a list of its elements. You have only to follow a few basic conventions:
- Separate the elements of a row with blanks or commas.
- Use a semicolon, ; , to indicate the end of each row.
- Surround the entire list of elements with square brackets, [ ].

This exactly matches the numbers in the engraving. Once you have entered the matrix, it is automatically remembered in the MATLAB workspace. You can refer to it simply as A. Expressions Like most other programming languages, MATLAB provides mathematical expressions, but unlike most programming languages, these expressions involve entire matrices. The building blocks of expressions are: a) Variables b) Numbers c) Operators and d) Functions

Express PCB:

Express PCB is a software tool to design PCBs specifically for manufacture by the company Express PCB (no other PCB maker accepts Express PCB files). It is very easy to use, but it does have several limitations. It can be likened to more of a toy then a professional CAD program. It has a poor part library (which we can work around). It cannot import or export files in different formats. It cannot be used to make prepare boards for DIY production. Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB patterns and use the toner transfer method with an Etch Resistant Pen to make boards. However, Express PCB does not have a nice print layout. Here is the procedure to design in Express PCB and clean up the patterns so they print nicely.

Preparing Express PCB for First Use:

Express PCB comes with a less then exciting list of parts. So before any project is started head over to Audio logic and grab the additional parts by morsel, ppl, and tangent, and extract them into your Express PCB directory. At this point start the program and get ready to setup the workspace to suit your style.

Click View -> Options. In this menu, setup the units for “mm” or “in” depending on how you think, and click “see through the top copper layer” at the bottom. The standard color scheme of red and green is generally used but it is not as pleasing as red and blue.

The Interface:

When a project is first started you will be greeted with a yellow outline. This yellow outline is the dimension of the PCB. Typically after positioning of parts and traces, move them to their final position and then crop the PCB to the correct size. However, in designing a board with a certain size constraint, crop the PCB to the correct size before starting.

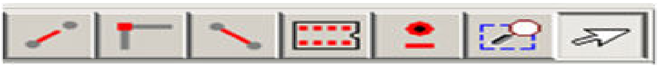

Fig 2: Tool bar necessary for the interface

- The select tool: When this tool is selected the top toolbar will show buttons to move traces to the top / bottom copper layer, and rotate buttons.
- The zoom to selection tool: does just that.
- The place pad: When this tool is selected the top toolbar will give you a large selection of round holes, square holes and surface mount pads.
- The place component: tool allows you to select a component from the top toolbar and then by clicking in the workspace places that component in the orientation chosen using the buttons next to the component list.
- The place trace: tool allows you to place a solid trace on the board of varying thicknesses.
- The Insert Corner in trace: When this tool is selected, clicking on a trace will insert a corner which can be moved to route around components and other traces.
- The remove a trace button is not very important since the delete key will achieve the same result.

Design Considerations:

Before starting a project there are several ways to design a PCB and one must be chosen to suit the project’s needs.When making a PCB you have the option of making a single sided board, or a double sided board. Single sided boards are cheaper to produce and easier to etch, but much harder to design for large projects. If a lot of parts are being used in a small space it may be difficult to make a single sided board without jumpering over traces with a cable. While there's technically nothing wrong with this, it should be avoided if the signal travelling over the traces is sensitive (e.g. audio signals).

PIC Compiler:
PIC compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. PIC compiler also supports C language code. We have to add header file for controller you are using, otherwise you will not be able to access registers related to peripherals.

```
#include <18F452.h> // header file for PIC 18F452//
```

Proteus:
Proteus is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed.

Procedural steps for compilation, simulation and dumping:
Compilation and simulation steps: For PIC microcontroller, PIC C compiler is used for compilation. The compilation steps are as follows:

- Open PIC C compiler.
- You will be prompted to choose a name for the new project, so create a separate folder where all the files of your project will be stored, choose a name and click save.

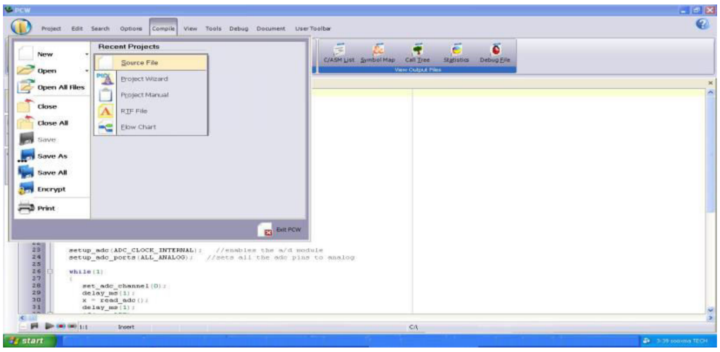

Fig 3: Picture of opening a new file using PIC C compiler

- Click Project**,** New, and something the box named 'Text1' is where your code should be written later.
- Now you have to click 'File, Save as' and choose a file name for your source code ending with the letter '.c'. You can name as 'project.c' for example and click save. Then you have to add this file to your project work.

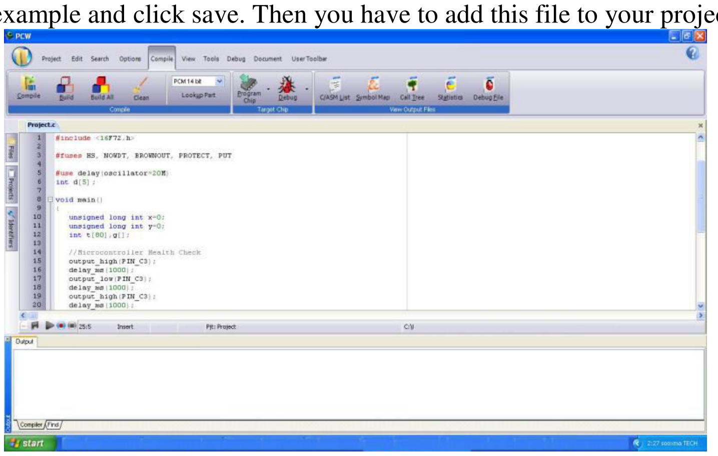

Fig 4: Picture of compiling a new file using PIC C compiler

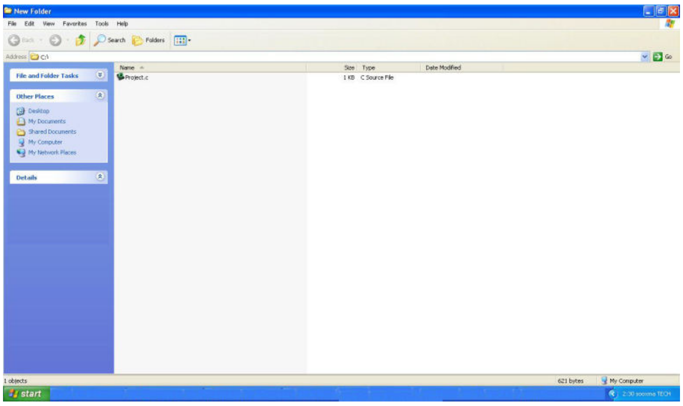

Fig 5: Picture of compiling a project.c file using PIC C compiler

- You can then start to write the source code in the window titled 'project.c' then before testing your source code; you have to compile your source code, and correct eventual syntax errors.

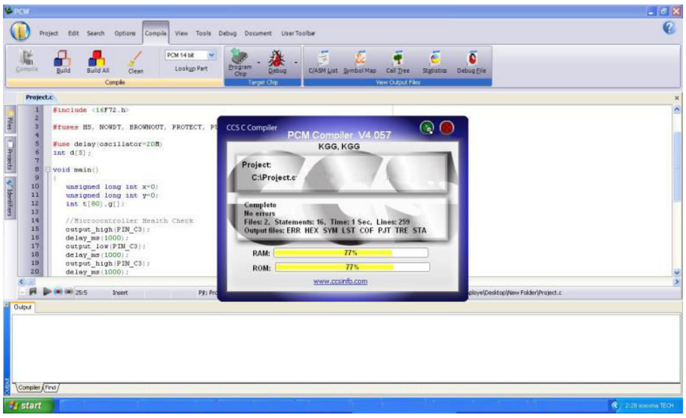

Fig 6: Picture of checking errors and warnings using PIC C compiler

- By clicking on compile option .hex file is generated automatically.
- This is how we compile a program for checking errors and hence the compiled program is saved in the file where we initiated the program.

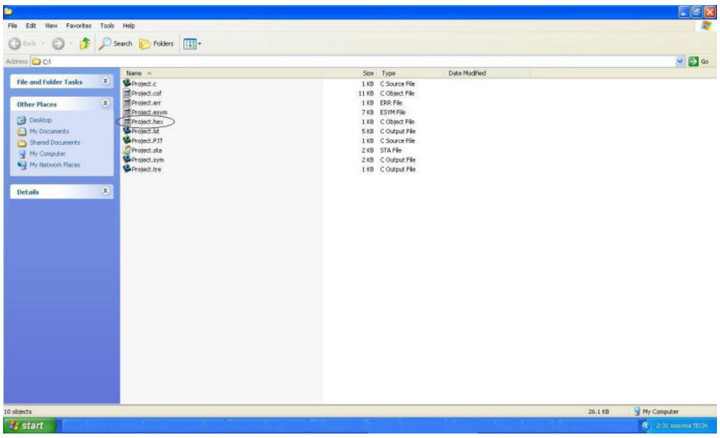

Fig 7: Picture of .hex file existing using PIC C compiler

After compilation, next step is simulation. Here first circuit is designed in Express PCB using Proteus 7 software and then simulation takes place followed by dumping. The simulation steps are as follows:

- Open Proteus 7 and click on IS1S6.
- Now it displays PCB where circuit is designed using microcontroller. To design circuit components are required. So click on component option.
  10. Now click on letter 'p', then under that select PIC18F452 ,other components related to the project and click OK. The PIC 18F452 will be called your "Target device", which is the final destination of your source code.

Dumping steps:

The steps involved in dumping the program edited in proteus 7 to microcontroller are shown below:

1. Initially before connecting the program dumper to the microcontroller kit the window is appeared as shown below.

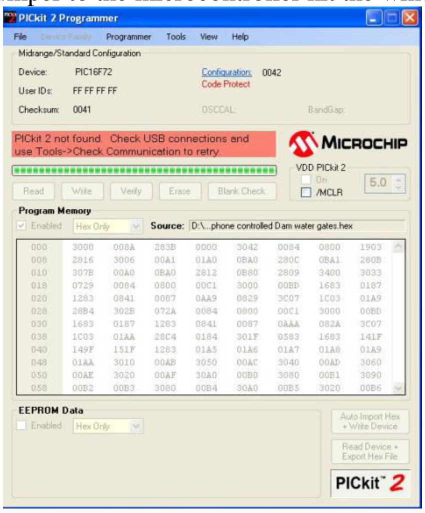

Fig 8: Picture of program dumper window

2. Import the pro Select Tools option and click on Check Communication for establishing a connection as shown inbelow window

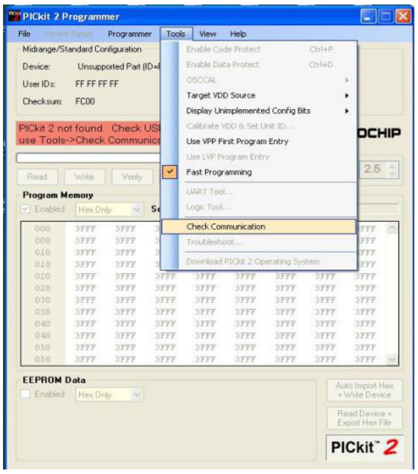

Fig 9: Picture of checking communications before dumping program into microcontroller

3. After connecting the dumper properly to the microcontroller kit the window is appeared as shown below.

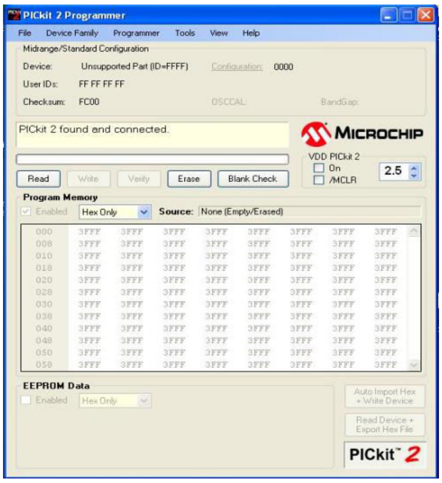

Fig 10: Picture after connecting the dumper to microcontroller

4. Again by selecting the Tools option and clicking on Check Communication the microcontroller gets recognized by the dumper and hence the window is as shown below.

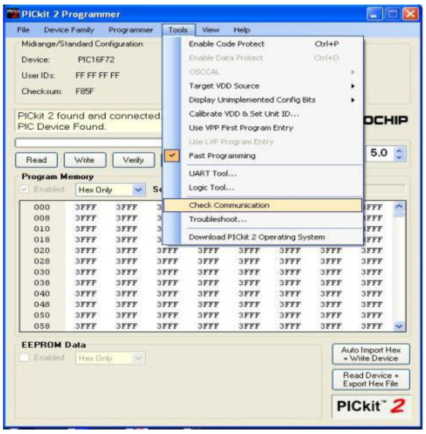

Fig 11: Picture of dumper recognition to microcontroller

5. Import the program which is '.hex' file from the saved location by selecting File option and clicking on 'Import Hex' as shown in below window.

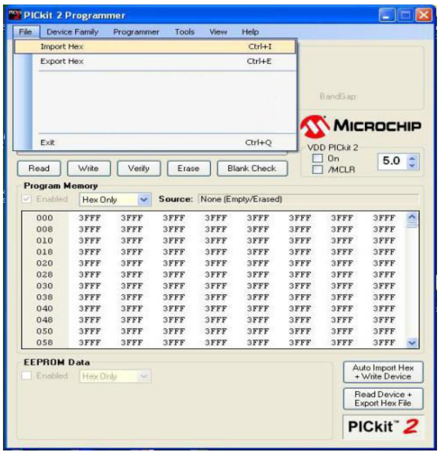

Fig 12: Picture of program importing into the microcontroller

6. After clicking on 'Import Hex' option we need to browse the location of our program and click the 'prog.hex' and click on 'open' for dumping the program into the microcontroller.

7. After the successful dumping of program the window is as shown below.

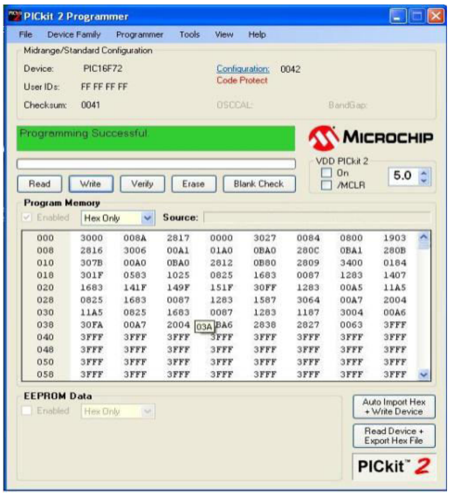

Fig 13: Picture after program dumped into the microcontroller

In this project, schematic diagram and interfacing of PIC18F452 microcontroller with each module is considered**.**

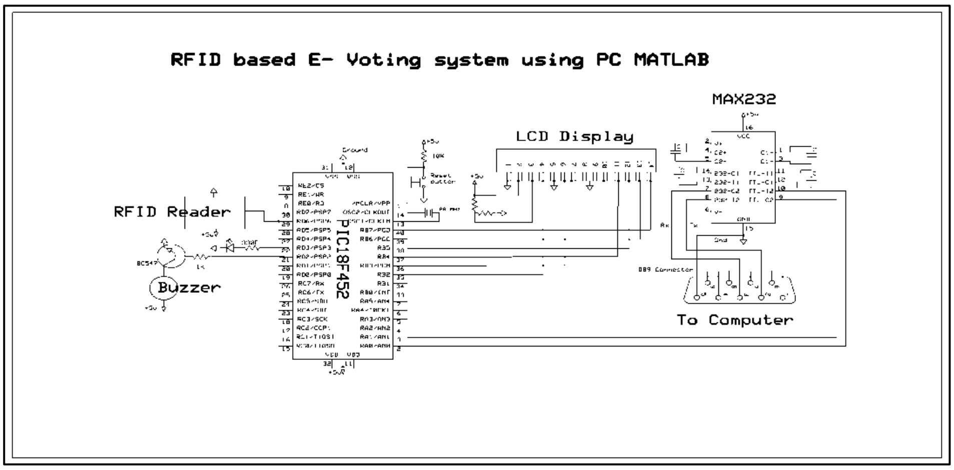

Fig 14: schematic diagram of RFID based E-Voting System

The above schematic diagram of RFID based E-Voting Systemexplains the interfacing section of each component with micro controller, RFID and Keypad. Crystal oscillator connected to 13th and 14th pins of micro controller and regulated power supply is also connected to micro controller and LED's also connected to micro controller through resistors. Thedetailed explanation of each module interfacing with microcontroller is as follows:

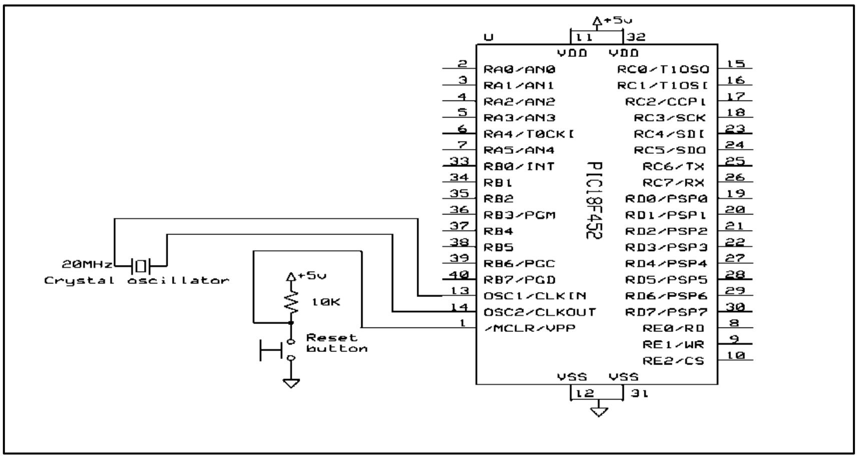

Fig 5.2: Diagram of crystal oscillator and reset input interfacing with micro controller

Advantages:

1. Highly efficient and user friendly design.
2. Easy to operate.
3. Low power consumption.

4. Efficient design.
5. Data logging into PC using RS232 cable.
6. MATLAB based image of authorized voter details display along with image on PC
7. Identification of voter through RFID communication.
8. Automatic display of voter details on LCD and also on PC.
9. Alerting through buzzer alarm system when the voter card is unauthorized.

Disadvantages:

1. Interfacing RFID reader with microcontroller is highly sensitive.
2. Interfacing PC with MATLAB supports only for limited distance as it is wired connected

Applications:

This system can be practically implemented in real time at places where security is a concern for voting applications at MNC companies, schools, colleges etc

RESULTS AND CONCLUSION

The project “RFID based E-Voting System” was designed an advanced e-voting system sing RFID and keypad with voter details instantaneously display on PC with MATLAB. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC’s with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.Our project “Electronic Passport using RFID” is mainly intended to design an advanced E-voting system using RFID and keypad which helps in getting the voter details instantaneously using RFID technology. And using the keypad user can enter the relevant password when the voter tag and the password matches then the user details are displayed on PC using MATLAB software. This is very much helpful for the election officers to extract the details of the individual’s person instantaneously and also to identify non registered persons.

The main aim of this project is to extract voter ID registration details based on RFID technology like name, image, phone number, address, age, voter ID number etc. In this project the RFID tags are used for identifying the authorized person, and the RFID reader which is interfaced to decodes the RFID tag of the particular voter individual details along with image and those particular authorized details are displayed on PC with MATLAB through RS232 cable. The user initially need to show the tag and also need to enter the unique password from keypad when the voter tag and password matches then the system declares the individual as authorized. The authorized individual can vote the candidate from the keypad. The individual detail along with image gets displayed on PC with MATLAB and the received data will be fed to PC. When any voter ID is recognized as unauthorized then the system alerts through buzzer alarm. The system also facilitates the voting data display when the election commissioner officer shows his tag and enters the password from keypad matches. The embedded C language provides effective environment in performing the task.This project can be extended using a GSM module. GSM module sends the alert message to the respective authorities when unauthorized card is detected by the RFID reader.The system can also be extended using Wi-Fi technology for unauthorized details display on androidmobilephone.

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The sites which were used while doing this project:

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2. www.allaboutcircuits.com
3.www.microchip.com
4.www.howstuffworks.com