Design and Implementation of Preferential Voting Machine using PIC18F4520

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Abstract
This paper describes designing and implementation of preferential voting machine both in hardware and software manner. In this author have implemented voting machine concept with microchip’s PIC18F4520 8-bit microcontroller and results are stored in I2C protocol based serial memory. For software part, authors have developed code in ‘C’ on Microchip’s MPLAB-IDE V8.66 and MPLAB C18 Compiler V3.37.01. The basic idea behind this design, one voter can choose any three candidates among others as per their desire.

Keywords
Preferential Voting Machine, PIC18F4520, Instant Run-off Voting Concept

I. Introduction
Electronic voting system has many advantages as compared to traditional paper ballot system. It leads to reduce the human interaction, reduce time in casting vote and for declaring results with secure voting. During elections, candidates stand from nominated parties and some stands independently. Public have option to select only one candidate which sometimes leads to eliminates the deserving candidate. It is based on the principle of “One person, one vote”. To eliminate such kind of problem; preferential voting machine has been designed. It is a type of voting machine, which allows the voters to vote more than one candidate according to their preferences. They can put on different preferences. But, repeatability is not allowed for same candidate by same voter. Voters cast votes according to ranking and when the result is displayed; candidate having maximum preferences declared as a winner. In an ordinary electronic voting machine, this option is not available. Basic idea behind developing this voting machine is that voters can independently rank different candidates. This machine is especially meant for votes; where more than one deserving candidates stands for same region. Voting machine consists of two units-
1. Control unit
2. Ballot unit
Control unit is under the supervision of polling officer and ballot unit is placed inside the voting booth. Only if the polling officer press button for ballot system then only voter is able to cast a vote.

II. Hardware Implementation
Authors have used 8-bit Microcontroller PIC18F4520. It consists of MSSP (Master Synchronous Serial Port) having two pins for I2C interfacing: SDA and SCL. These pins are interfaced with AT24C02, I2C protocol based serial memory. It is used for storing the results.

Its contents remained save even if there is power lost. 16x2 character LCD in 8-bit mode is interfaced with microcontroller for displaying purposes. Switches are interfaced with PIC18F4520 for command and polling purposes. Command switches are used to initialize the voting process; result declaration whereas polling switches are used for casting the votes.

III. Software Tools Used
MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC18F microcontrollers. MPLAB-IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB-IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB-IDE has the same user interface for all tools.

MPLAB® C Compiler for PIC18 MCUs-
The MPLAB® C Compiler[2] for PIC18 MCUs (also known as MPLAB C18) is a full-featured ANSI compliant C compiler for the PIC18 family of PICmicro® 8-bit MCUs. MPLAB C is a 32-bit Windows® console application as well as a fully integrated component of Microchip’s MPLAB Integrated Development Environment (IDE), allowing source debugging with MPLAB’s software and hardware debug engines. Projects, compiler switches and linker customizations can be controlled completely within MPLAB IDE to provide a full graphical front end for this powerful compiler. Text errors in source code and breakpoints instantly switch to corresponding lines in the proper file, and watch windows show data structures with defined data types, including floating point, array and structures.

A. Features [1]
• ANSI '89 compatibility
• Integration with the MPLAB IDE for easy-to-use project management and source-level debugging
• Generation of re-locatable object modules for enhanced code reuse
• Compatibility with object modules generated by the MPASM assembler, allowing complete freedom in mixing assembly and C programming in a single project
• Transparent read/write access to external memory
• Strong support for inline assembly when total control is absolutely necessary
• Efficient code generator engine with multi-level optimization
• Extensive library support, including PWM, SPI, I2C, UART, USART, string manipulation and math libraries
• Full user-level control over data and code memory allocation
• Supports both a small (16-bit pointers) and a large (24-bit pointers) memory model for efficient use of memory
- MPLIB allows easy use of included libraries and for user created libraries
- Extensive multi-pass optimizations
- Supports new PIC18F extended mode instructions

**B. Program Flow**

1. Initialise MSSP module, LCD as output port, switches as input
2. Implemented three conditional statements for single switch (one candidate) 1. Switch detection 2. Flag 3. Time
3. When particular switch is pressed, corresponding memory location gets incremented. When three switches are pressed, flag bit is set. Time indicates preference for candidate.
4. Same sequence is repeated for displaying data on LCD with hex to ASCII conversion.
5. Candidates having maximum preferences declared as winner, intermediate as second winner and least as third winner.

Authors have developed code in ‘C’ language using MPLAB-IDE and C18 Compiler by Microchip. The hardware programming is handled by MPLAB integrated environment with MPLAB C18 compiler for PIC18F. Microchip’s PICKIT-3 In-Circuit debugger/programmer is In-circuit debugging logic incorporated to provide low cost hardware debugger and programmer. It can be used with powerful graphical users of MPLAB-IDE.

**IV. Software Implementation**

The main logic to develop an algorithm is to store the polled value into EEPROM memory location. In this algorithm, each candidate has allotted three different memory locations for different preferences. Whenever the vote has been cast its corresponding memory location gets incremented regardless all memory locations are set to be zero values. Authors have developed an algorithm in ‘C’ so that any voter can press three switches among the all switches to set their preference; first pressed switch has been considered as a first preference and corresponding memory location gets incremented. When any voter cast votes thrice for different candidates then ‘flag’ variable gets set and next sequence get initialize for next voter. While developing this code, In-built routines have been used from Microchip’s I2C libraries supported for PIC18F under the header file ‘i2c.h’. For data to be write on particular memory location of I2C; in-built routine EEByteWrite (Address, Location, Data) is used where “Address” parameter is for I2C as per hardware, “Location” for candidate, “Data” value to be implemented. Similarly, to read results from memory location to get displayed on LCD; in-built routine EERandomRead (Address, Location) is used in conjunction with hex to ASCII function which is suitable for displaying ASCII value for character LCD.

**V. Conclusion**

Microchip’s PIC18F and I2C are suitable for storing and retrieving value from serial memory. So, Authors have preferred and developed algorithm as well as program which is successfully worked as preferential voting machine. However, it is also suitable for selecting three posts among other candidates. Its circuit complexity is low. Right to reject option can also be implemented in it.
References


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