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MICRO-CONTROLLER BASED CUMULATIVE GRADE POINT AVERAGE (MICGPA) CALCULATOR

G. N. EZEH [1]
Department of Electrical/Electronic Engineering,
Federal University of Technology, Owerri,
NIGERIA.

E. C. EZEH
Department of Electrical/Electronic Engineering,
Federal University of Technology, Owerri,
NIGERIA.

A. GEORGE
Department of Electrical/Electronic Engineering,
Federal University of Technology, Owerri,
NIGERIA.

C. F. INYA
Department of Electrical/Electronic Engineering,
Federal University of Technology, Owerri,
NIGERIA.

ABSTRACT

As enrollment of students into tertiary education in Nigeria continues to increase, the need for an efficient and speedy method of measuring academic performance of students has become more significant. This study designed and implemented a Micro-Controller based cumulative Grade Point Average (MICGPA) Software calculator for easy and speed computation of CGPA of students. The aim of the study is to present a novel high speed, hand operated and cheap software calculator for processing students' results. The software development process adopted modular technology in which each module has specific structure and function. In this study, the design depends on Micro-Controller (AT895S2) for the control, processing and storage functions. The software was developed based on High level C-language and compiled using Resonance Integrated Development Environment (RIDE). Results of computations with the new software calculator were found to agree with the manually computed results with a higher degree of precision.

Keywords: Design, High Level Language, Implementation, Micro-controller, Modular Technology.

INTRODUCTION

This centaury is witnessing a transformation in the way high education is delivered and supported. The driving force of this transformation is the need for institutions to deliver higher education in a more effective manner while transacting its processes even more economically (Turnbull *et al.,* 2005; Ezeh, 2010; Ezeh *et al.,* 2011). Computation of Cumulative Grade Point Average (CGPA) of students is becoming a prime importance due to the need for measuring the academic performance of students in tertiary education all over the world. The concept of grading student's work quantitatively was developed by William Farish and first implemented by University of Cambridge in 1792 (What is CGPA, 2011). Since then, several modifications have been made on student's performance grading system.

Although, there are various devices developed to help achieve easy and accurate computation of CGPA, most of them are tedious, time consuming and expensive. This study designed and implemented a Micro-Controller based Cumulative Grade Point Average (MICGPA) software calculator for easy and speedy computation of CGPA of Students. The software development process adopted modular technology in which each module has specific structure and function. The design depended on Micro-Controller (AT895S2) for the control, processing and storage functions (Muhammad *et al.,* 2009; Javan, 2007; Barret, 2008). The software was developed based on high level C-Language and compiled using Resonance Integrated development Environment (RIDE) (Michael, 2005; Michael, 2008).

[1] Corresponding Author: Ugoezeh2002@yahoo.com

OBJECTIVES OF THE STUDY

The main objectives of this study include the following:

a. To develop a system that makes the computation of CGPA faster and easier.
b. To eliminate the cost of acquiring a computer set and major software packages needed just for the calculation of CGPA.
c. To provide a reliable, user friendly and portable CGPA calculator that is affordable and handy to students.

CGPA COMPUTATION METHODS

Methods for computation of CGPA include, pen and paper method and software on computer method among others. While the pen and paper method is cheap, tedious, time consuming and prone to mistake, the software on computer method is accurate and fast at the expense of cost, portability and ease of operation. The need for a system that will be able to combine the good qualities of existing methods, with elimination of their setbacks gave impetus to this present design of Micro-Controller base CGPA calculator. An extensive review of literature showed great disparity on grading system among countries. It was observed that there is no globally accepted standard format for computing CGPA. Most nations have individual grading systems unique to their own institutions. In China, for most of the 985 Universities and colleges, the grading system is divided into five categories as shown on table 1. Also, in the United States of America (USA), academic grading system commonly takes on the form of five grades on a four point scale (Grade Education, 2011). The USA grading system is as shown on table 2. This study is based on a five-point grading system as:

Table 1. Tabulated grading system of China

Grade	Remark	Mark (%)
A	Excellent	90 – 100
A-	Excellent	85 – 89
B	Good	80 – 84
B-	Good	75 – 79
C	Satisfactory	70- - 74
C-	Satisfactory	65 – 69
D	Pass	60 – 64
F	Fail	0 - 59

Table 2. Tabulated grading system of USA

Grade	**Percentage**	**Grade point**
A	90 – 100	4
B	80 – 89	3
C	70 – 79	2
D	60 – 69	1
E/F	59/Below	0

Stipulated by the Nigerian University Commission (NUC) as tabulated on table 3.

Table 3. NUC tabulated grading system

Grade	**Mark/score (%)**	**Grade point**
A	70 – 100	5
B	60 – 69	4
C	50 – 59	3
D	45 – 49	2
E	40 – 44	1
F	0 – 39	0

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REQUIREMENT ANALYSIS

Requirements gathering and analysis, otherwise known as feasibility study was accomplished through visits to some representative higher education institutions. The existing conditions in respect of CGPA computation were investigated using oral interviews, observation and evaluation of existing records. Result of requirement investigation and data gather on the exiting situation justified the need for the development of a micro-controller based CGPA calculator. In developing the calculator, the following attributes were responded to:

a. Cost effectiveness and durability
b. Simple and more practical than elegant calculator
c. Accuracy, precision, reliability, portability and user friendly.
d. Modular technology

SYSTEM OVERVIEW

There are various development approaches which are employed during software development process and these approaches are generally referred to as software development process models. In adopting modular technology, four main modules were identified as follows: Power Supply Unit, Input Unit, Output Unit and Control Unit. Each module was design individually and then joined together to form a complete unit for CGPA computation. The different modules are controlled by a series of C-programs linked into the control unit. Figure 1 shows the system block diagram.

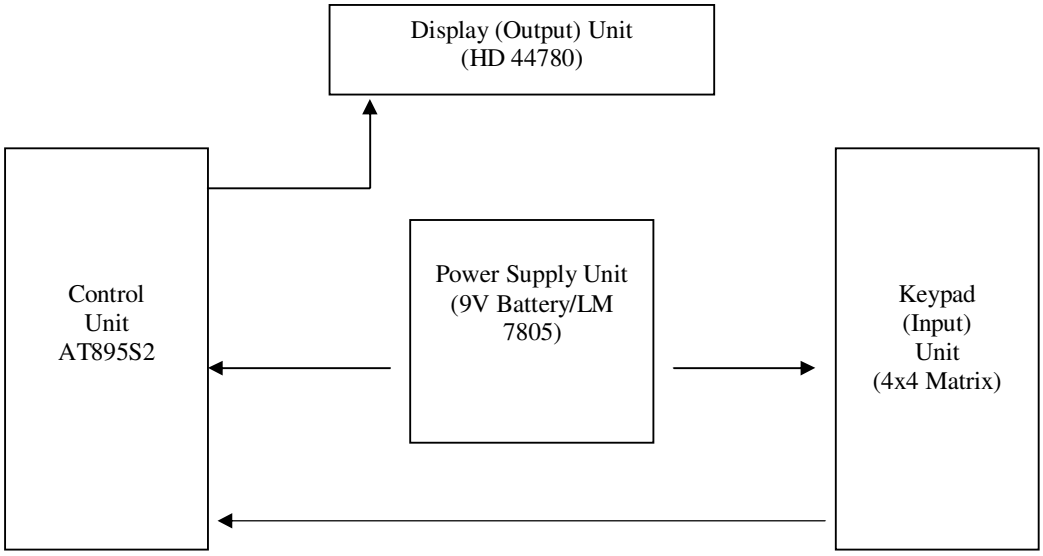

Figure 1. System Block Diagram

Power Supply Unit

The power supply unit provides the electronic circuit with necessary direct voltages and current with low level of A.C ripples and good stability. The power supply comprises of a transformer, a rectifier, a fitter and a regulator.

Input Unit

The 4 x 4 keypad used in this design serves as an input unit through which the user communicates with the system. This keypad is an alphanumeric keypad. It is used since the calculation of CGPA involves both numbers and alphabets.

Output Unit (LCD)

The LCD (HD 44780) used for the design of this CGPA calculator is a 16 x 2 LCD. The 16 x 2 implies that the LCD can display 2 rows of 16 characters each. It has a back-ground light which enhances readability in low light conditions.

Control Unit

The microcontroller is CPU of the CGPA calculator. It gives instructions, accepts inputs through the keypad, process it, and displays the processed output through the LCD.

System Design

In the system design, the flow diagram 2a – 2c show how the system works. It carefully illustrates the flow of instructions from one step to the other during operation.

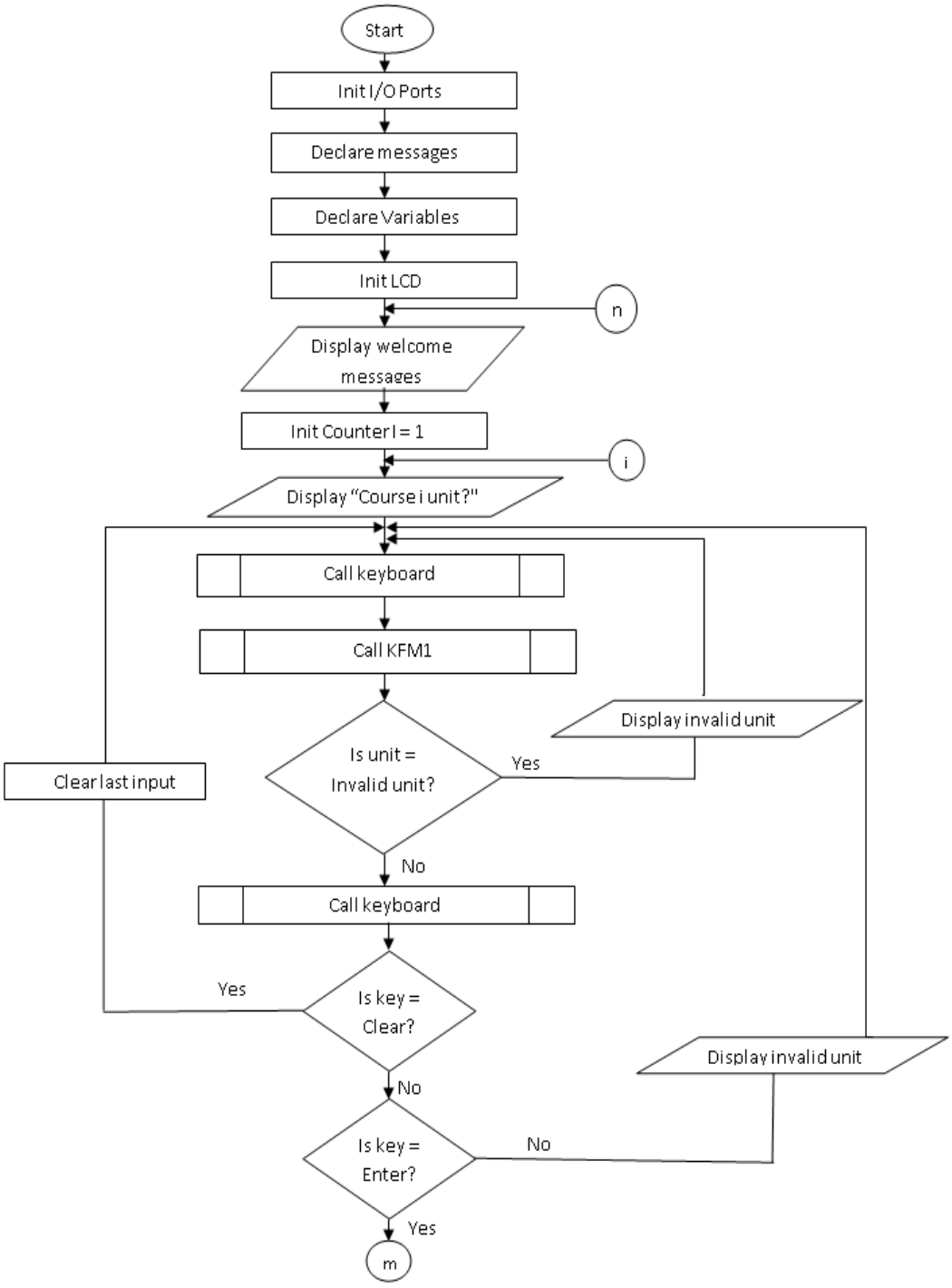

Figure 2 (a). Program Flowchart

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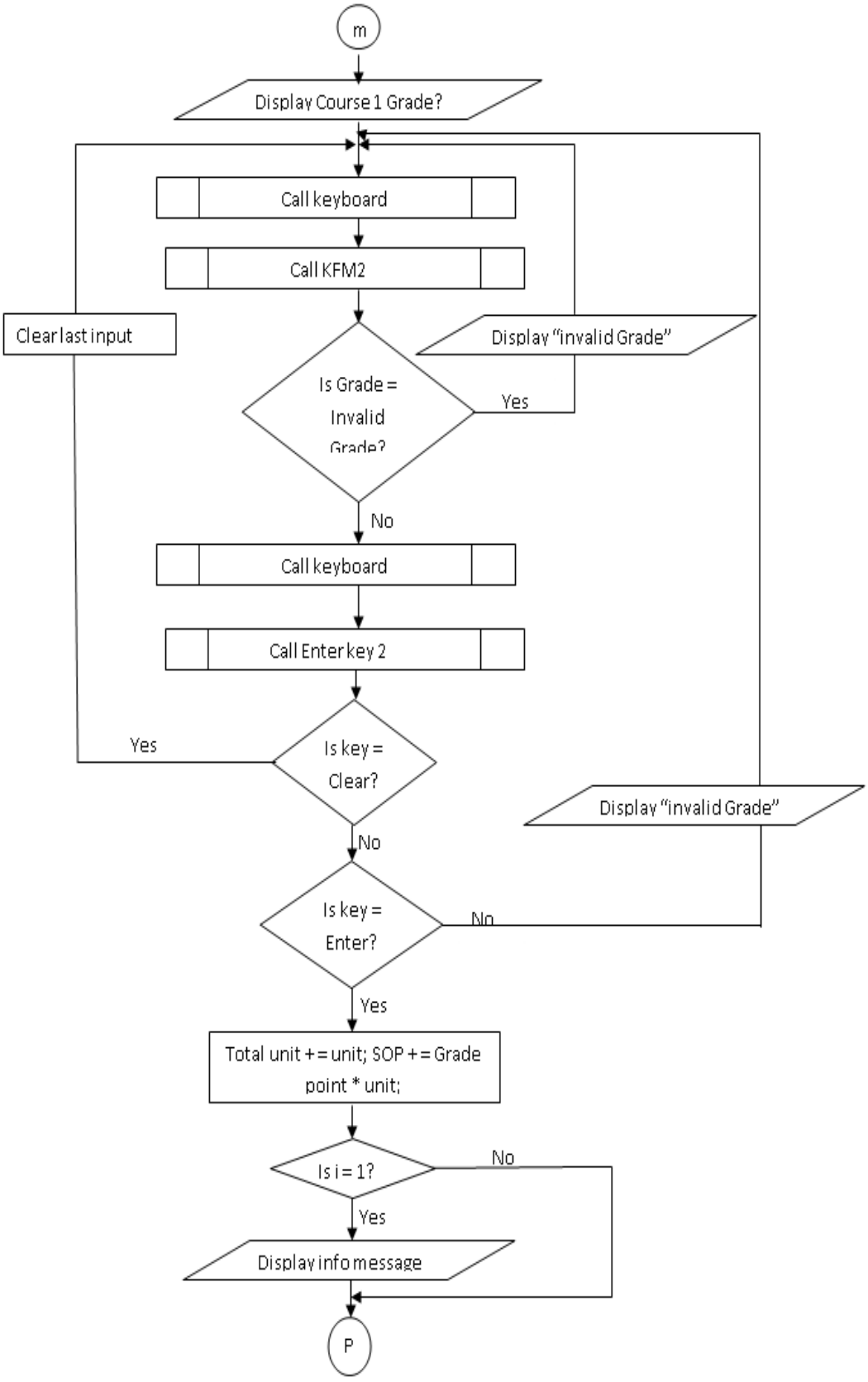

Figure 2 (b). Program Flowchart Continues

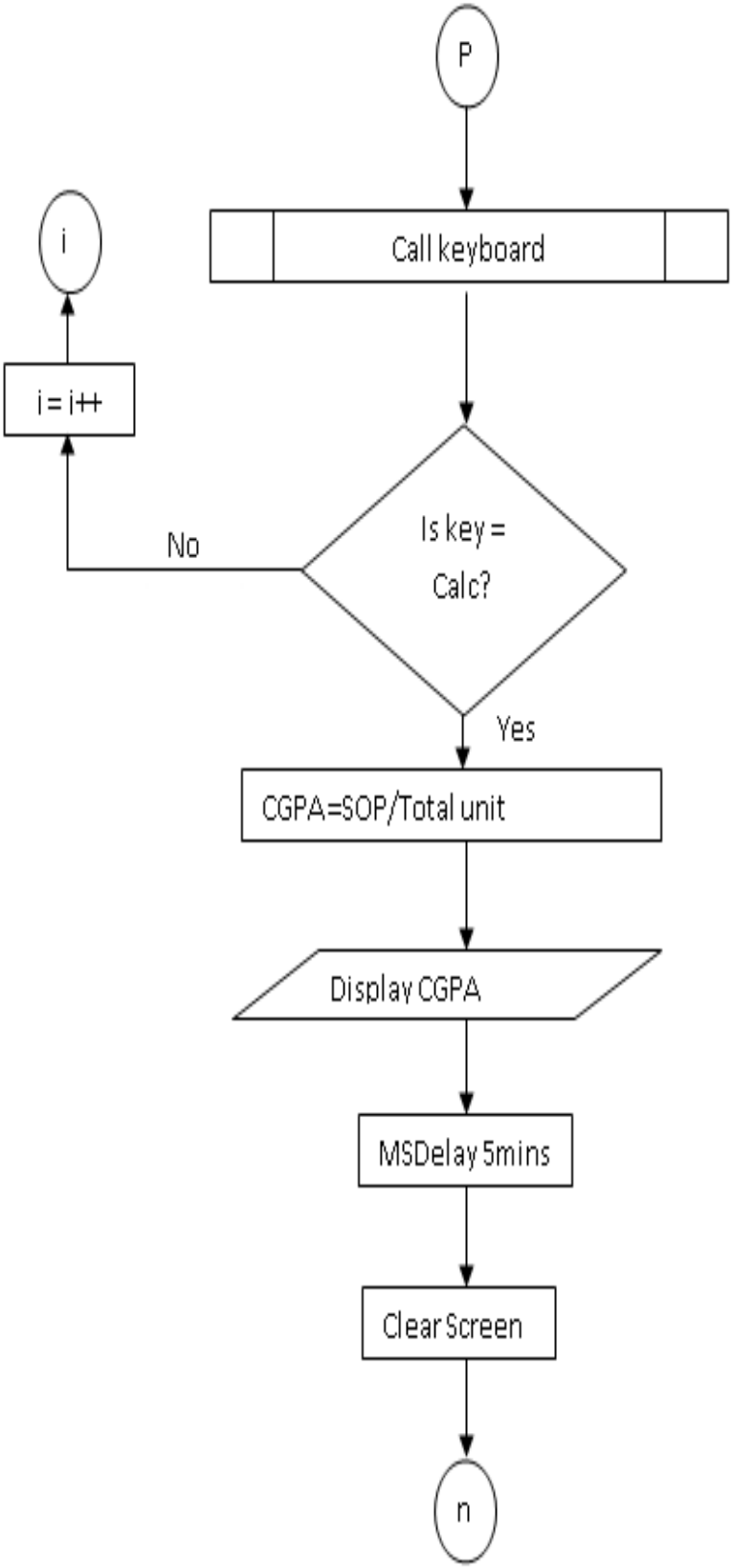

Figure 2 (c). Program Flowchart Continues

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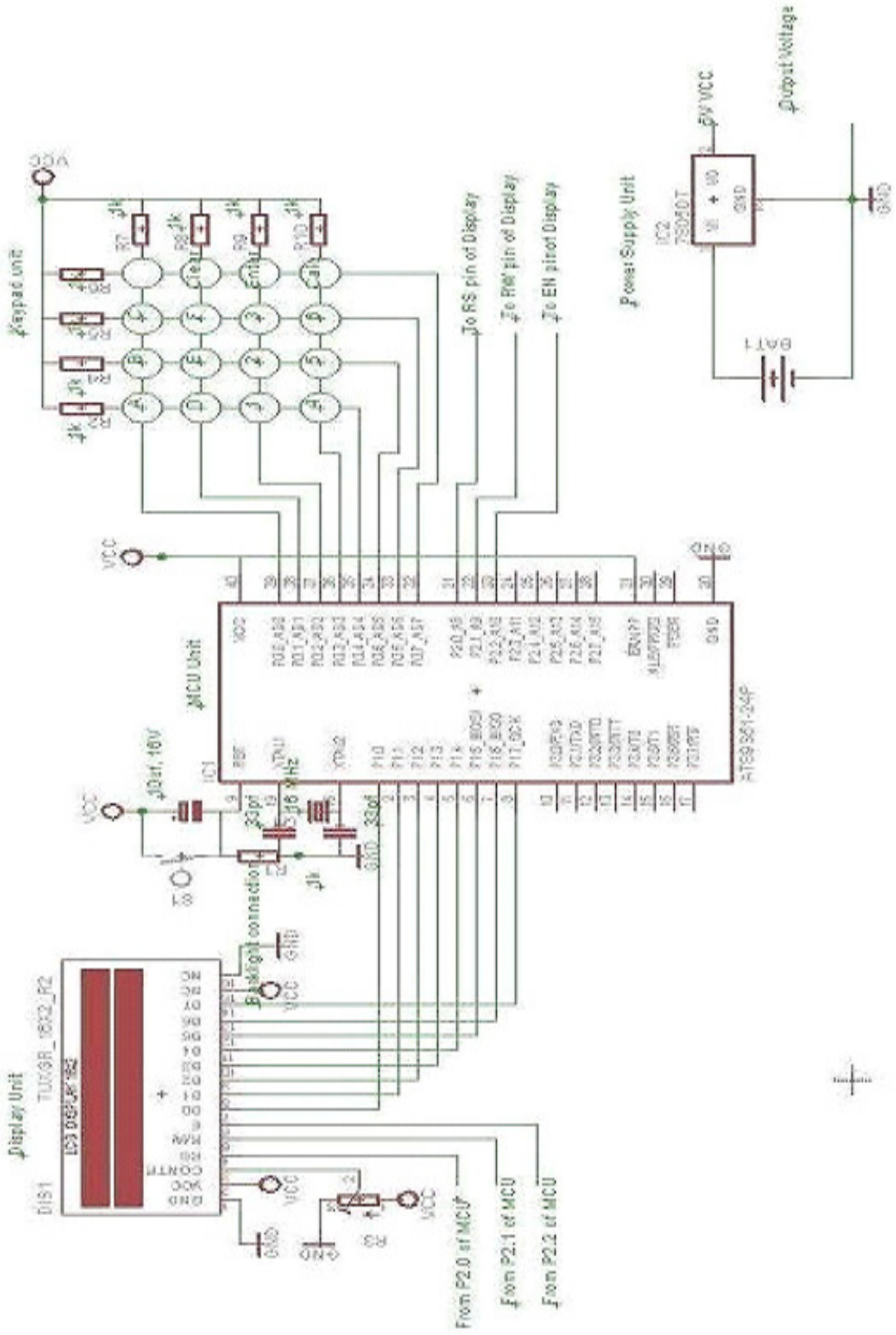

Figure 3. Circuit Diagram of the Completed Design

SYSTEM IMPLEMENTATION AND TESTING

This section, discusses the act of accomplishing the task of this project. The main objectives of this study are to provide a reliable, user friendly and portable CGPA calculator that helps students to compute their CGPA. Based on the user requirements and system design, a simple programming tool called Raisonance Integrated Development Environment (RIDE) was used.

Before doing the actual prototype implementation, simulations were carried out to test if the codes were working correctly. A sampled result was obtained and this was compared with that of manual calculated CGPA. The following results were observed:

1. The results obtained from both methods are numerically equal.
2. The result obtained from the electronic means has a higher precision since the designed calculator can give a precision of up to 4 decimal places.

CONCLUSION

Computation of Cumulative Grade Point Average (CGPA) is becoming a prime importance due to the need for measuring academic performance of students in tertiary education all over the world. Higher institutions cannot continue to ignore the need for a portable, reliable, low cost and faster means of computing CGPA of their students. This study designed and implemented a Micro-Controller based Cumulative Grade Point Average (MICGPA) software calculator for easy and speedy computation of CGPA of students. The Micro-Controller AT895S2 base was programmed with C-language and compiled using Resonance Integrated Development Environment (RIDE). Results of computation with the new software calculator were found to agree with the manually computed results with higher degree of precision.

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