*Staffordshire*
U N I V E R S I T Y

**Faculty of Computing,**
**Engineering and Sciences**

**MODULE HANDBOOK**

Automotive Embedded Software
CESCOM10266-5
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This module is chiefly concerned with the application of C programming as an aid to the production of embedded software. It expounds the need to write functional, testable portable ANSI C code, in this instance targeting 68HC11 family hardware. Assessment is in the form of a single assignment to form an assessment profile of 100% in course assessment. The module is especially suited to clients with an interest in writing portable embedded programs for industrial applications.

This handbook contains the following
Module Specification form
Lecture/tutorial/laboratories guidance
Student centered learning guidance
Module Assessment
Teaching plan
Reading list
Assessment profile/handing in details
Assignments and marking criteria

| Learning Outcome | |
|---|---|
| 1. EXTEND ANSI C PROGRAMMING TO INTERFACE TO MICROPROCESSOR HARDWARE (ELECTRO/MECHANICAL). | Analysis |
| | Application |
| | Problem Solving |
| 2. UNDERSTAND THE CONNECTION BETWEEN ANSI C AND THE EMBEDDED ENGINEERING PRODUCT. | Analysis |
| | Application |
| | Problem Solving |
| 3. APPLY THE DEVELOPMENT CYCLE OF EMBEDDED SYSTEM DESIGN TO A ENGINEERING APPLICATION. | Analysis |
| | Application |
| | Problem Solving |

## Lecture/tutorial /laboratories guidance

The emphasis within the module will be on applying existing knowledge of microprocessor systems and high-level languages to the particularly demanding area of embedded systems software. The methods of teaching used will include a small amount of formal lecturing to reinforce existing knowledge and to introduce new concepts related to multi-tasking programs within an embedded environment. This will be combined with supervised tutorials to enable the client to achieve the learning outcomes of the module as they indicate practical skill outcomes. Each client is expected to prior read the lecture material according to the teaching plan. This approach allows the client to attempt to fully understand the material before the lecture and hence use the lecture as a second source of information in able to clarify the notes given. The notes given provide formal lecture material and embedded tutorials with solutions provided. These tutorials enable learning to occur and hence it is expected that the client will work on these in the formal supervised tutorials/ practical sessions

## Student centred learning guidance
It is expected that the client will use this time to practice the tutorials provided in the notes and in prior reading for the next formal lecture. A large proportion of the time will be used in the production of the tutorial solutions and assignment.

## Module Assessment
The assessment model for this module is 100 % in course assessment comprising one assignment. The marking of assessments will be in line with the current practice per late submission, ill heath etc. as stated in the Student handbook issued to the client.

## Reading list
The following books may be useful, however the work pack provided coupled with additional personal study should provide a good basis for successful completion of the module.

Title Using the M68HC11 micro controller: a guide to interfacing and programming the M68HC11 micro controller by Skroder John C
Publisher Upper Saddle River: Prentice-Hall 1997
ISBN 0131206761

Software engineering for real-time systems by Cooling Jim
Addison-Wesley 2003
ISBN: 0201596202

Real-time systems and software by Shaw Alan C
John Wiley and Sons 2001
Subjects Real-time systems
ISBN: 0471354902

**Teaching plan**

| Week/Date Sem1 | Lecture Topic Covered | |
|---|---|---|
| 1 ( / / ) | Introduction to Micro-controllers | **Practical** First time guide to 68hc11 using assembly and C |
| 2 ( / / ) | Computer Number Systems<br>Hardware design of a typical system | **Practical**<br>First time guide to Visual C |
| 3 ( / / ) | Introduction to C<br>Variables, IO, Conditional statements and loops<br>Further features of C<br>Functions, Arrays and bit manipulation | **Practical**<br>**C Exercises** |
| 4 ( / / ) | String Storage within C<br>Pointers and structures<br>Stream Input /Output functions<br>structures | **Practical**<br>**C Exercises** |
| 5 ( / / ) | Assignment brief in full | **Practical**<br>Assessment part 1 |
| 6 ( / / ) | Programming of Micro-controllers<br>Peripheral Devices on the 68HC11FN4 | **Practical**<br>Parallel and serial Port exercise |
| 7 ( / / ) | Serial Port Communication | **Practical**<br>Serial Port exercise |
| 8 ( / / ) | ADC 7 channel converter<br>Intro to timer | **Practical**<br>ADC, timer,exercise |
| 9 ( / / ) | Timer interfaces<br>Handling Interrupts | **Practical**<br>ADC, timer, interrupt exercise |
| 10 ( / / ) | Inside the C environment and start up code | **Practical**<br>Assessment part 2 |
| 11 ( / / ) | **Practical**<br>Assessment part 2 | **Practical**<br>Assessment part 2 |
| 12 ( / / ) | **Practical**<br>Assessment part 2 | **Practical**<br>Assessment part 2 |

## Assessment profile/handing in details

| Title | % Weighting | Handing in Date | Module Areas covered |
|---|---|---|---|
| Assignment | 100 | Via Blackboard | FIRE ALARM SYSTEM |

## Assignment and marking criteria

If any part of the assignment and/or marking criteria is not clearly understood please seek clarification from the lecturer.

**Faculty of Computing,**

*Staffordshire*
UNIVERSITY

**Engineering and Sciences**
**MODULE ASSIGNMENT**

**Email :**                                  **Year: 3**
**Module Title/Code :**
**Assignment Number: One**
**Title of Assignment: Fire Alarm system**
**Submission date : Blackboard submission Week 12**
**Assessor: James Mc Carren**

| Criteria | Mark | Comments |
|---|---|---|
| **Full report consisting of** | | |
| *Part 1: Visual Studio ANSI C* | | |
|    *Structured Design Approach* | /15 | Excellent Good Fair Poor   None<br>☐     ☐  ☐  ☐    ☐ |
|    *Program Listing and function* | /30 | Excellent Good Fair Poor   None<br>☐     ☐  ☐  ☐    ☐ |
|    *Testing* | /15 | Excellent Good Fair Poor   None<br>☐     ☐  ☐  ☐    ☐ |
| *Part 2: 68hc11 Embedded solution* | | Excellent Good Fair Poor   None |
|    *Porting to 68hc11 code* | /20 | ☐     ☐  ☐  ☐    ☐ |
| | | Excellent Good Fair Poor   None |
|    *Testing* | /20 | ☐     ☐  ☐  ☐    ☐ |
| **Overall Mark** | /100 | **Grade or %** |

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# Assignment- Fire Alarm Embedded System

## Assessment Method:

You are required to write an overall Microsoft word report consisting of two parts

      A) Full structured design of Visual studio ANSI C program with software design approach, and full functional testing.

      B) Port the Visual C program to run on the 68hc11 micro-controller and document method of porting and full functional testing.

## Assignment:

You are required to write a Visual studio C program that is ported to enable the 68HC11 target system to function as a sophisticated burglar alarm system.

### Basic Program Specification

The system is to monitor **9** separate alarm circuits via the 68HC11 parallel ports that can be split into three fire zones (3 trips per zone). Each zone must be capable of being enabled or disabled when the alarm is set via a menu driven interface on the system terminal. If the alarm is activated then the system should activate a single bit of a port output and display the alarm status on the system terminal, until the password is entered. The program should log a limited number of set/alarm events (100 MAX) in memory and print these to the screen when required by the user.

**Stages in Development:**

**Step One**: Write a C program to input and bit display the data from Port A

**Step Two:** Implement a real time clock

**Step Three:** Implement a routine to keyscan the serial port i.e mygetchar without the need for Carriage return

**Step Four:** Extend the Real time clock to include a simple data logger of the zones and display the log via a menu

**Step Five:** Combine all the above elements to form a working commercial system.

**Step Six:** Extend the program to include an additional 9 loopback circuits to enable the continuity of the trips to be tested

The program is required to be compiled and linked for use from the system RAM area.