DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING,
KUMARAGURU COLLEGE OF TECHNOLOGY,
COIMBATORE – 641006.

MARCH 2004

P-1121

DATA ACQUISITION AND CONTROL SYSTEM

Project Report

Submitted in partial fulfillment of the
Requirement for the award of the degree of the

Bachelor of Engineering in Information Technology of
Bharathiar University, Coimbatore.

Submitted by

R. Kalaivani (0027S0081)
Rincy Rosalind Gloria M.(0027S0098)
R. Sivakumar (0027S0107)

Under the guidance of

Dr. S. Thangasamy, Ph.D,
Head of the Department,
Computer Science and Engg.

CERTIFICATE

KUMARAGURU COLLEGE OF TECHNOLOGY
(Affiliated to Bharathiar University, Coimbatore)

CERTIFICATE

This is to certify that the project entitled

DATA ACQUISITION AND CONTROL SYSTEM

done by

R. Kalaivani (0027S0081)
Rincy Rosalind Gloria M.(0027S0098)
R. Sivakumar (0027S0107)

And submitted in partial fulfillment of the
Requirement for the award of the degree of the

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S. Thangasamy

Professor & Head Of the department
(Dr.S.THANGASAMY)

S. Thangasamy

Project Guide
(Dr.S.THANGASAMY)

Certified that the candidates were examined by us in the project work
Viva voce examination held on 26-03-04.

Internal Examiner

External Examiner

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PIC/PERS/PROJ/2004
Dated: 22-March -2004

TO WHOMSOEVER IT MAY CONCERN

We are pleased to issue this certificate in the process of operationalising our "Industry- Institute interaction synergy" drive.

Name of Student	:	**KALAIVANI (REG NO. 0027S0081)**
Name of the Institution	:	KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE-641006
Course	:	B E(INFORMATION TECHNOLOGY), FINAL YEAR
Title of the Project	:	DATA ACQUISITION AND CONTROL SYSTEM
Period	:	OCTOBER-2003 TO MARCH- 2004
Performance	:	Very Good
Conduct / Decorum	:	Very Good

We wish the student the very best in her professional & personal endeavor.

For **PREMIER INSTRUMENTS & CONTROLS LTD.,**

ANTHONY THIAGARAJAN
Manager – Human Resources

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Period	:	OCTOBER-2003 TO MARCH- 2004
Performance	:	Very Good
Conduct / Decorum	:	Very Good

We wish the student the very best in her professional & personal endeavor.

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Title of the Project	:	DATA ACQUISITION AND CONTROL SYSTEM
Period	:	OCTOBER-2003 TO MARCH- 2004
Performance	:	Very Good
Conduct / Decorum	:	Very Good

We wish the student the very best in her professional & personal endeavor.

For **PREMIER INSTRUMENTS & CONTROLS LTD.,**

ANTHONY THIAGARAJAN
Manager – Human Resources

DECLARATION

DECLARATION

We,

R. Kalaivani [0027S0081]
Rincy Rosalind Gloria M. [0027S0098]
R. Sivakumar [0027S0107]

Declare that the project entitled " **Data Acquisition and Control System**", is done by us and to the best of our knowledge, a similar work has not been submitted earlier to the Bharathiyar University or any institution, for fulfillment of the requirement of the course study.

This project report is submitted on the partial fulfillment of the requirement for all awards of the degree of **Bachelor of Engineering in Information Technology** of Bharathiyar University.

Place: Coimbatore

Date : 24-03-04

Kalaivani.R.
[R. Kalaivani]

[Rincy Rosalind Gloria M.]

[R. Sivakumar]

Project Guided by,

Dr. S. Thangasamy, Ph.D,
Head of the Department,
Computer Science and Engg.

DEDICATED TO OUR BELOVED

PARENTS AND FRIENDS

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

First of all we would like to thank God for his abundant grace and mercies without which this project would not have been taken up and successfully completed.

We are grateful to our Principal **Dr.K.K. Padmanabhan B. Sc. (Engg), M.Tech, Ph.D**, Kumaraguru College of technology, Coimbatore for the overall support that he provided during the project work.

We express our heartfelt thanks to our internal guide, **Dr. S. Thangasamy, Ph.D**, Professor and Head of the Computer Science Department, Kumaraguru College of Technology for his sound counsel and timely guidance for the successful completion of this project.

We are indent to express our heartiest thanks to **Mrs. S. Devaki M.S.,** project coordinator who has helped us to perform the project work extremely well.

We are extremely thankful to **Ms. P. Sudha, B.E.,** Class Advisor, for providing us a great support throughout this project.

We would fail in our duty, if we do not thank **Premier Instruments and controls Ltd, Coimbatore** for giving us this opportunity. We would like to extend our sincere thanks to the following executives for their immense help in the project.

Sri. A. Venkatesan, General Manager (Information Systems)
Smt. Subashini, Manager (Information Systems)
Sri. Sivakumar

Our sincere word of thanks for all the staff members of Kumaraguru College of technology, Coimbatore for the help rendered in the successful completion of this task.

SYNOPSIS

SYNOPSIS

The industrial revolution gave a new outlook to the manufacturing field of the country. The increased production demanded the need for optimization. To optimize it is essential that the whole process is monitored keenly. With the advent of computers, the burden of record keeping was minimized. In addition to that, the counting operation can also be automated.

We undertook the project entitled "Data Acquisition and Control System" considering the importance of keeping track of the components produced in an industry. Our project is directed to "Premier Instruments and Controls Limited, Coimbatore".

The production machine is capable of performing various kinds of operations and producing different components. Thousands of components are produced every day. The production of each component should be registered carefully.

Our project is aimed at counting the number of components produced and recording in the database. We have not stopped with just counting. We've provided an interface which allows the operator to start a shift by entering the identification of the employee, component to be produced and the process involved. Similarly, he ends the shift at the specified time.

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INTRODUCTION

1. INTRODUCTION

The counting operation of the manufacturing industry should be automated in order to efficiently keep track of its production. Also it is required to keep an account of the employees and the components produced by them. For this, there has to be a facility to record the details about the operator, the component he is supposed to produce and the process involved at the start of every shift.

It would be easy for the operator to use an interface attached to every machine rather than using the PC at the cabin manager's end to sign in at the start of every shift. The operator can start a shift by selecting the required details using the interface.

For supervision to be made easy, the current status of the machine namely normal, no operator, waiting for tool, waiting for raw material, etc., should be indicated with the help of lights. Hence by looking at these lights, the supervisor would be able to know the status of the machine. As the shift progresses, the currently produced and currently expected quantity of the component should be displayed in the interface so that the operator is reminded about the quantity he should have produced at that instance.

The details registered at the start of every shift are sent to the PC and stored in the corresponding database. The count is updated in the database at regular intervals.

ORGANIZATIONAL PROFILE

2. ORGANIZATIONAL PROFILE

Premier Instruments Coimbatore Limited was established in 1974 to manufacture automotive products. In 1981 renamed as Premier Instruments & Controls Limited - started to manufacture Precision Machine tools.

PRICOL function with a corporate vision: Strive for excellence in all we do through socially and environmentally acceptable means

The corporate Mission of the company is: We will have market leadership through customer delight. We will be a responsible corporate citizen and share the benefits with society. We will make our customers; employees, suppliers & shareholders feel proud of our association and want a long-term relationship with us.

Their TPM Policy is to establish an excellent Total Productive Manufacturing System with total involvement of all employees to achieve effective utilization of all resources.

Most importantly they strongly follow a quality policy which is: PRICOL will provide value and satisfaction to customers on products and services. This will be achieved through systematic training and motivation of employees.

According to them," **One weak link can break the quality chain**"

Hence quality should be guaranteed at all levels.

In 1999 established Plant III and Plant IV at Coimbatore, to rationalize the manufacturing operations and to improve on the products – Oil pumps, Auto fuel cocks, Valves, Chain tensioners, Gears & Pinions and Disk brake systems for two wheelers. The spares parts required for these products are also manufactured by them.

SYSTEM STUDY

3. SYSTEM STUDY

3.1 EXISTING SYSTEM AND LIMITAIONS:

A manufacturing industry would be equipped with a number of production machines for example a lathe. Several operations such as drilling, shaping, etc. can be done on different parts of the machine. For a single shift, only one operation or process is done on the component and only one operator handles the machine. The time of production of one component averagely ranges from one minute to five minutes.

There are three working shifts of eight hours each per day. Each operator is assigned to handle different machines for every week or month. But for any shift, there is a set of employees who may turn up to possibly handle the machine. This is decided by the shop floor supervisor. Similarly he decides the possible component and process for that shift.

In the current system the counting process is done manually which is always prone to errors. Therefore to reduce the burden of manual labor, to monitor the process and to avoid the errors being committed regarding the updation and calculation of production automation is required.

The limitation of the available system is that it has a number of keys on the key-pad which gives a possibility of entering wrong information. It is a waste of time for the operator to use a large number of keys to enter data. Ultimately the integration of the time wasted by all the operators will result in reduced production.

3.2 PROPOSED SYSTEM:

To overcome the existing difficulties, and to enhance the capabilities, we propose a micro controller unit and a client server system with the user friendly front end and a powerful backend thereby wholly computerizing the procedure. We use Visual Basic for the front end and Microsoft Access for the back end.

The hardware interface provided by us is more user friendly with limited number of keys. The machine operator who is one of the end user can select the required details by using just four switches. Hence he need not waste time in entering details. The time can be effectively used for production.

Since entering details may lead to errors, we propose a system in which the operator only selects the required details and sets it. The status of the machine can be set by the operator or the cabin manager and is indicated with the help of four LEDs.

The operator is the end user for the micro controller unit (DACS hardware interface) and the cabin manager is the user for the software run at the PC. The software at the cabin manager's end should be efficient enough to view all the conditions of the machine. Both the units should be user friendly and interactive.

SYSTEM REQUIREMENT ANALYSIS

4. SYSTEM REQUIREMENT ANALYSIS

4.1 PRODUCT DEFINITION:

The Data Acquisition and Control System acquires the data from the production machine, records in the database and produces reports as and when required. The counting starts from the start of each shift to the end.

The cumulative production at any instances along with the target expected should be displayed continuously so that the operator is reminded about the quantity he should have produced for that instance.

4.2 PROJECT PLAN:

The project entitled "Data Acquisition and Control System" is to develop a sensor unit which is fixed at the production part of the machine, a hardware interface attached to the machine. The interface is designed to be used by the operator who inputs the shift details and views the current status of the machine, the number of components currently produced and currently expected.

A software is developed to be used by the cabin manager (shop floor supervisor). This software allows the cabin manager to supervise the status of the machine from his cabin. Reports are produced to depict the efficiency of the machine at any required period.

The cabin manager acts as the shop floor supervisor. The system allows him to supervise all the machines in the shop floor by just sitting in his cabin. The data from all the machines can be integrated and given to the notice of the cabin manager.

SOFTWARE REQUIREMENT SPECIFICATION

5. SOFTWARE REQUIREMENT SPECIFICATION

Introduction:

Purpose:

The purpose of our project titled **"Data Acquisition and Control System"** is to monitor the production of components in a particular machine. The user interface developed is used to enter the details like operator id, component id and process id and to display the production details at that time. Reports are generated as and when required.

Scope:

Our project is applicable to all the production machines that are to be monitored. Our project is easily modifiable and can be made to monitor a set of machines by attaching the DACS hardware interface to each machine and interconnecting them.

Product Overview:

The microcontroller is a programmable single chip integrated circuit (IC) that controls the various operations of a system. It plays a significant role in the everyday functioning of industrialized societies. It can be viewed as a data processing unit or a computing unit of a computer. This embedded into a system meets special requirements such as cost effectiveness, low power, and high level of system integration.

Our project provides every possible flavor in monitoring the entire component counting process while managing to provide an interactive interface to be used by the operator of the machine.

As applications become more demanding so is the need to have a powerful hardware to churn out the information fast. It becomes important for both the hardware and software to process the information as fast as possible. In our project we us RS 232 for the purpose of communicating with the PC.

The entire working of the system can be divided into two fronts- one the software part and the other the hardware part. This real time control application uses C as the software part and the hardware part comprises the necessary electronic components and circuit boards.

This application is made up of many modules in order to carry out the work in a synchronized manner. Our system not only counts the components but also indicates the status of the machine with the help of four LEDs.

The working of the system is quite simple. It involves the controller in listening to the various signals through the ports. Different ports are allocated to different services. When a valid signal is received, the controller calls in the appropriate routine for handling them.

The sensor being placed in the production part of the machine detects the component as it is produced and sends input to the MCU. Signals received are detected with the help of PIC micro controller.

The PIC micro controller senses the pressing of the switches connected to its ports. Each switch has a particular function as defined in the micro controller coding. When a switch is pressed, the corresponding routine is executed.

Definitions and Acronyms:

DACS	:	Data Acquisition and control systems
PIC	:	Peripheral Interface Controller
RS232	:	Serial port connector
LCD	:	Liquid Crystal Display
LED	:	Light Emitting Diode
MAX232	:	IC used to provide compatibility between serial port and PIC Controller

FUNCTIONAL REQUIREMENTS

Hardware Module:

A user interface would be developed so that it is made easy for the operator to set the details rather than entering the details using a PC.

List of inputs:

- Signal from the machine.
- Signal from the switch board.
- Data received from the PC.

Information processing requirement:

Every time the pulse is detected the count is incremented by one in the PIC. This count must be sent to the PC every minute or whenever it gets incremented.

According to the switch pressed the corresponding function should be performed.

Data received from the PC has to be stored in EEPROM for further processing.

Output:

The output of processing when the switches are pressed should be displayed on the LCD screen and also with the help of LEDs.

When the shift details are set, the data must be transmitted to the PC via RS 232 connector.

Software Module:

This module should be designed in order to create a user interactive screen to be used by the cabin manager for various purposes like monitoring the machine, adding new employee or component record, and for generating reports of the production.

List of inputs:

- Count and other details from the hardware interface through the RS 232 connector.
- Details regarding the new employee, product and component entered by the cabin manager.
- The dates for which the reports are to be generated.

Information processing:

The information obtained from the hardware interface should be first differentiated whether it is count or shift details and updated in the corresponding database.

Separate databases should be maintained for employee, component and process. Whenever a new entry for employee, component or process arrives, it must be recorded in the database.

The reports should be generated in the forms of graph like pie, bar for the details in the records between the specified dates.

Output:

As the count is incremented it should be visible in the screen along with the current expected count for the corresponding component. The details of the shift must also be displayed.

HARDWARE AND SOFTWARE SPECIFICATION

6. HARDWARE AND SOFTWARE SPECIFICATION

6.1 HARDWARE CONFIGURATION

- Pentium III processor and above.
- 64 MB RAM
- GB Hard Disk
- 104 Keys Keyboard
- PIC16F876 Microcontroller
- Transformer
- MAX 232 IC
- Infrared Sensor
- 4 LEDS
- 2 line LCD
- 4 Tactile Switches
- Transistors
- Crystal oscillator
- Active and passive components
- PROPIC Programmer
- VDD(4.5V - 5.0V)

6.2 DESCRIPTION OF SOFTWARE AND TOOLS

MPLAB :

MPLAB is a windows-based Integrated Development Environment(IDE) for the Microchip Technology Incorporated PIC Microcontroller families.

MPLAB allows you to write, debug, and optimize PIC micro applications for firmware product designs.

MPLAB tools allows us to:

- Assemble, Compile and Link source code
- Debug the executable logic by watching the program flow with the simulator, or in real time with the MPLAB-IDE emulator
- Making timing measurements
- View variables in watch windows
- Program Firmware with PROPIC

MPLAB is an easy-to-learn and use Integrated Development Environment (IDE).The IDE provides firmware development engineers the flexibility to develop and debug firmware for Microchip's PICmicro Microcontroller families. The MPLAB IDE runs under Microsoft Windows 3.1x,Windows 95,98,NT, and 2000.

MPLAB provides functions that allows you to

- Create and edit source files
- Create files into projects
- Debug source code
- Debug Executable Logic using the Simulator or Emulators.

PROPIC2 :

The main features are:

- Extensive number of PIC supported
- Command line interface (can be used in a batch file)
- Fast E2PROM programming (program a 24C65 memory in 7 seconds)
- Editable Program and data window
- Upgradable via Internet
- Connects via Parallel- or Com-Port.
- Write, readback and verify Flash- and EEProm Memory

C:

The C language source increases the readability of the program structure and eases the maintenances. This benefit has come at the cost of the program size. That in terms of memory words has considerably increased over the equivalent code written in assembly (more than 30% larger). Programming in C increases the efficiency of the MC and is easy to use relative to assembly.

Introduction to Visual Basic:

Visual Basic has been chosen as it provides a GUI based environment for creating user-friendly forms. Visual Basic is an ideal programming language for developing sophisticated applications in Windows platform. The 'Visual' part refers to the graphical user interface (GUI). Rather than writing numerous lines of code to describe the appearance and location of interface elements, we simply use prebuilt objects into place on the screen. The 'Basic' part refers to the BASIC language. Visual Basic has evolved from the original BASIC language and now contains several hundred statements, functions and keywords, many of which relate directly to the Windows GUI.

Beginners can create useful applications by learning a few keywords yet the power of the language allows professionals to accomplish anything that can be accomplished using any other windows programming language. It makes use of Graphical User Interface(GUI) for creating robust and powerful applications. The GUI enables the users to interact with an application. This feature makes it easier to comprehend things in a quicker and easier way. In a GUI environment, coding is similar to linear programming methods and it is highly interactive and user-friendly.

One of the interesting features of Visual Basic is the Integrated Development Environment (IDE). Another important feature of Visual basic is that it has easy methods to allow users to control and access databases. The front end can also be connected to the databases via ODBC,JDBC,etc.

Microsoft access as the back end tool:

MS Access is a powerful multi user DBMS used to store and manipulate large amount of information and automate repetitive tasks such as maintaining and retrieving records. The data in access is organized in the form of tables within a table, records are arranged according to a common reference value known as the primary key field. The key value is unique and helps in identifying the records. A combination of 2 or more fields can also be used as primary key. Databases in access have the default extension (.mdb). MS Access also maintains index files for tables. The index object provides access to data.

Features of MS Access:

- Can be used by both beginners and those who have previous DBMS experience.
- Has an interface similar to windows nt.
- Capable of handling large volumes of data spread across several databases and users.
- Lets you import from or to support to foxpro excel oracle and other data formats.
- Includes small programs known as functions that perform simple calculations or data formatting.
- Access includes mathematical, financial, date time function.
- Primary indices or auto increment fields can be given without difficulty.
- Easy to establish parent child relationship among tables.
- Has a locking facility which prevents users from updating same records.

User Interfaces, Screen Formats

The user interfaces to be designed will be user-friendly so that no other professional training is required on the user part. The user can select the details required by using the switches and viewing the LCD display. Once the shift is started, the currently produced and the currently expected component count will be continuously displayed on the LCD screen.

DESIGN DOCUMENT

7. DESIGN DOCUMENT

Input design:

Reliable input design ensures accurate output from a system. The system to be designed is configured with the following data.

- Signal from the switches.
- Input pulse from the sensor.
- Signal from MAX 232.

Output design:

Output from the system are required to communicate the results of processing to the users. Reports can be generated as and when required.

The outputs of the system are the following.

- Signal from the MCU to the PC.
- Signal from the MCU to the LCD and the LED
- Data stored in the EEPROM of the MCU.

Database design:

The database is defined as an integral collection of data. The overall objective in the development of database technology has been to treat data as an organizational resource and as an integrated whole.

The database contains:

1. Personal details of the employee
2. Details about the Component.
3. Details about the Process
4. Shift Details

Process design:

Process design gives the series of operations designed to process the various signals to the MCU. There are four switches to facilitate the operator to interact with the system.

- Function
- Increment
- Cursor
- Set

The process design is divided into sub modules which includes the following.

Shift Start:

This module is to start a shift by the employee. For this purpose it is necessary to set the emp id, comp id, and pro id in the PIC memory and transmit it to the PC.

The system would set each shift to the employee to produce the particular component and process. To start the shift the function key is pressed. When the cursor is in the "Start Shift" position, the set switch is pressed in order to enter the shift details. The required ID can be selected by using the increment switch. The cursor switch is used to move to the next element (ie.between Emp id, comp id, pro id).

After the required values are selected, the set switch is pressed to send the details to the PC .

End Shift:

At the completion of the eight hours shift, the operator selects "End Shift" by repeatedly pressing the function switch. Then when the cursor is at the "End Shift" position, the set switch is pressed to end the shift.

Status code:

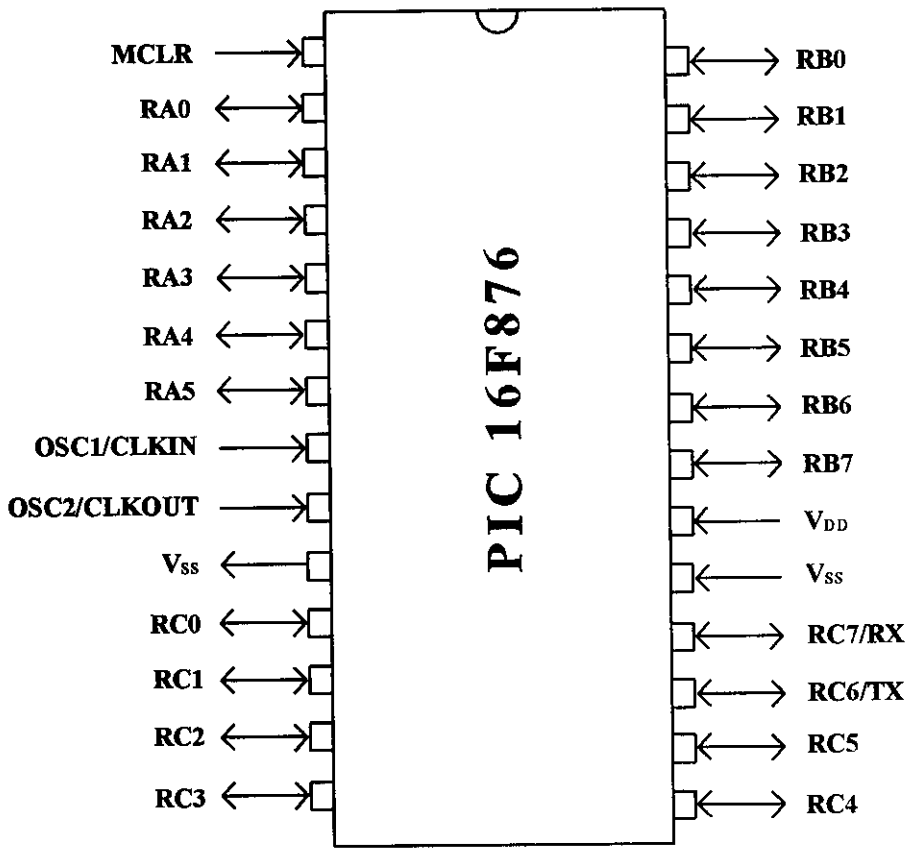
The status of the machine can be set by selecting the "Status Code" when the function switch is pressed. As the increment switch is pressed, each status is displayed on the LCD screen and when the required status is reached it is set. This status sent to the PC and is indicated with the help of LEDs. Hence a glance at the set of LEDs will give a clear idea of the status of the machine.

Sensor unit:

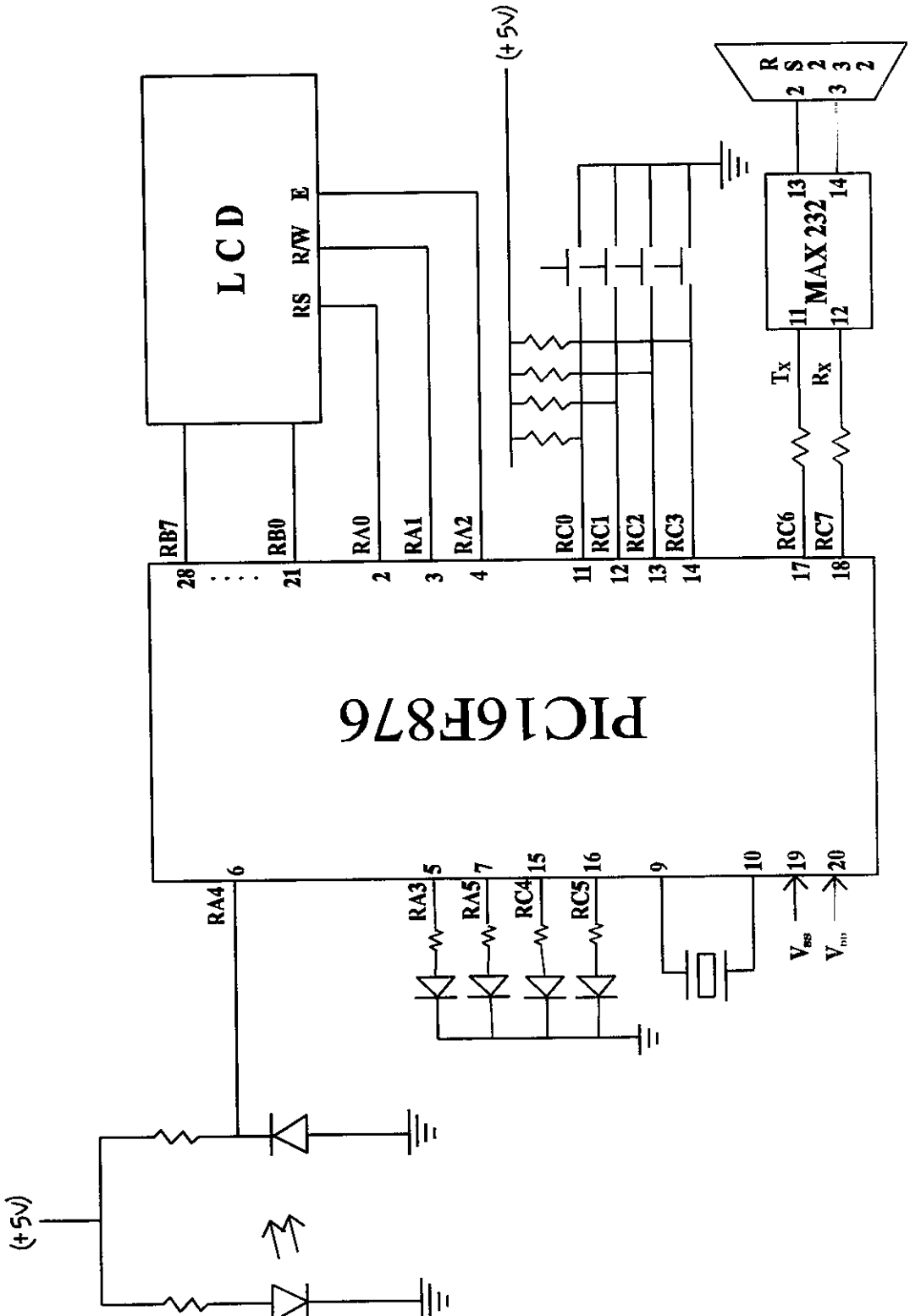
The IR sensor is placed in the machine in such a way that the count produced is efficient. For every component produced a signal is generated which is sent as input signal to the PIC16f876. Hence the count is incremented for every signal received. The count is sent to the PC as and when it is incremented or at regular intervals of one minute (whichever occurs first). The actual count and the expected value are displayed in the LCD.

All the above details sent to PC are stored in the database which can be used for future reference. A hardcopy can also be generated which gives the production details in the form of graphs.

Pin Configuration of 16F876:

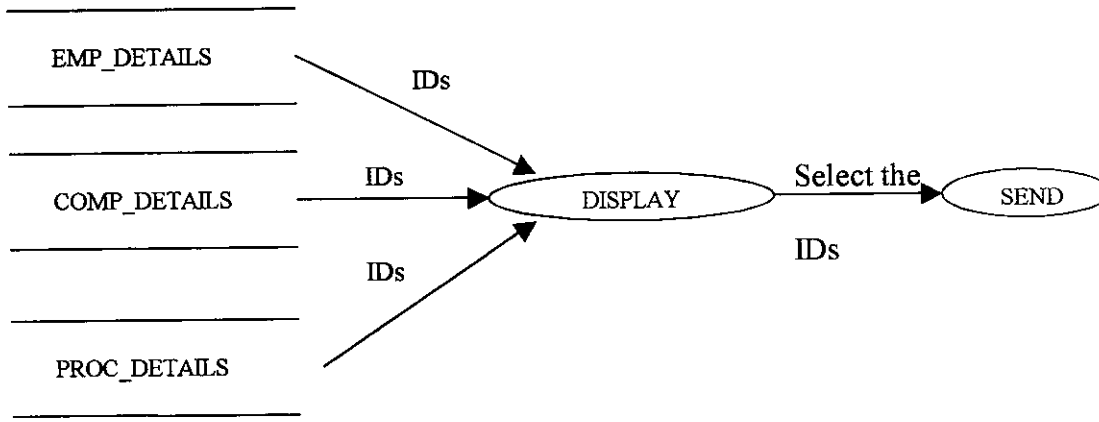


Circuit Design:

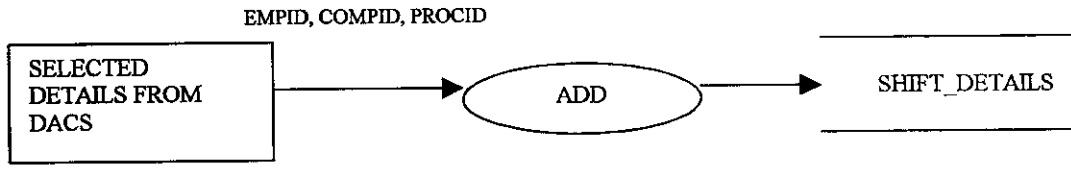


DATA FLOW DIAGRAM

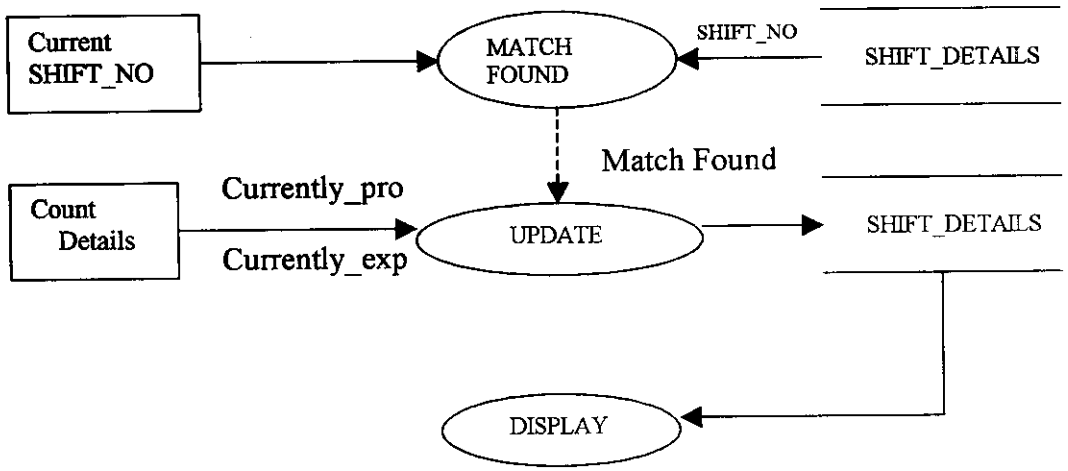
ID SELECTION:



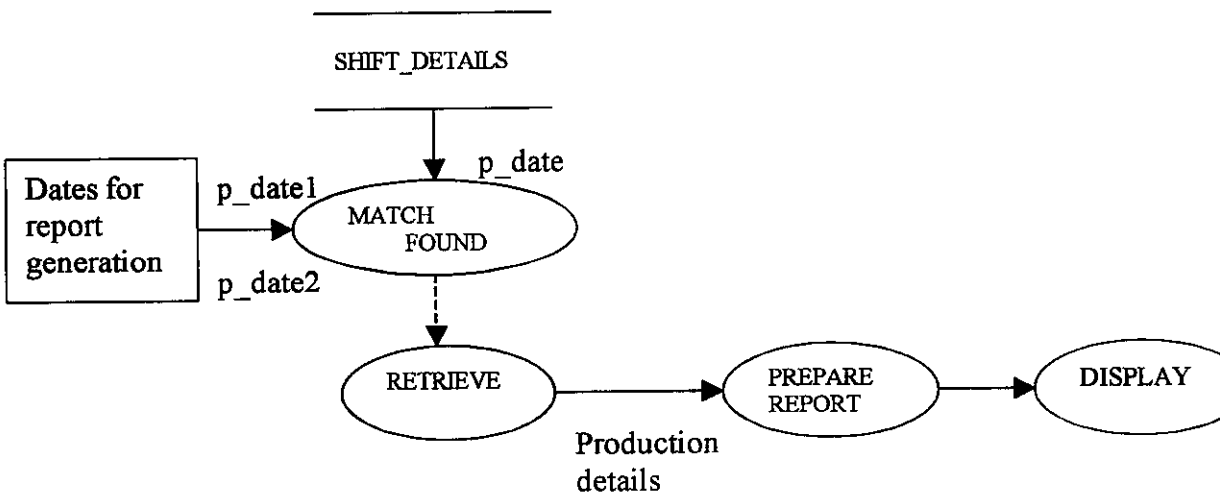
SHIFT DETAILS:



COUNT UPDATION:



REPORT GENERATION:



IMPLEMENTATION AND TESTING

8. SYSTEM IMPLEMENTATION

8.1. System Implementation:

Considering the basic functional requirements, the micro controller PIC16F876 is chosen. This circuit design involves the selection of the port pins for various input and output processes. They are as follows:

Port B pins (RB0 to RB7)	:	Data lines to the LCD
RA0,RA1 and RA2	:	Control lines to the LCD - R/W - Enable - RS
RC0,RC1,RC2,RC3	:	Tactile switches
RC6	:	Transmit
RC7	:	Receive
RA3,RA5,RC4,RC5	:	LEDs
RA4	:	Signal from sensor

Once the port pins for various control signals are selected, software routines are written for the microcontroller to move data in and out through the ports. This programmed controller includes a routine to check for the occurrence of the external interrupt from the infrared sensor, a routine to check for the switch inputs, a write up routine for the EEPROM memory, a routine to initialize LCD, a routine for the LEDs

Sensor Unit:

The IR transmitter and receiver are positioned at sensing points of the machine. The output of the sensor unit is given to the RA4 pin of the micro controller. When the IR rays from the transmitter reaches the receiver without any disturbance, the RA4 pin is low. Whenever a component cuts the rays, the signal to the RA4 pin is high. Since the RA4 pin is configured to sense the rising edge and the timer0 of the PIC is configured in counter mode, the transition from low to high leads to an increment in the count.

Switch board:

During idle condition of the switches the input to the pins RC0 – RC3 is 1.

When a switch is pressed the input to the corresponding pin becomes 0. This is detected and the routine corresponding to that switch is executed.

Write up routine for the EEPROM memory:

The reading and writing operations of EEPROM are done by setting the respective registers accordingly. The set of employee, component and process ids are stored in the EEPROM when transmitted from the PC (set by the cabin manager).

Initializing LCD:

The display is cleared and ready for further data.

LED unit:

The four LEDs are used to display the 16 status codes in binary

format. The LED glows when the corresponding bit of the status code is 1.

Transmit and Receive:

The built in USART is used to transmit and receive data to and from the PC. The MAX 232 which is a 16 pin IC is used to obtain compatibility between TTL and RS232.

8.2. Testing:

When the implementation planning is completed, our first step is to convert the existing files of the system, to the format required by our system. This step requires very careful attention. We need controlled procedures to implement this step. When the files are converted, we can then use them in the new system.

The programming is done in the MPLAB IDE using the C language. Once the code is completed as per the implementation logic, it is built using the HiTech compiler. The HiTech compiler creates an hex file.

Thus the program and the routines are loaded into the controller. For this purpose PROPIC 2 programmer is used. The PROPIC 2 is a Microchip Microcontroller development programmer that enables us to program user software into PICmicro Microcontroller devices. This is done in three steps:

- Load the file.
- Set the required configuration.
- Write the file.

Once the PIC is programmed, it is then placed on the hardware for testing.

Testing is an activity to verify that a correct system is being built and is performed with the intent of finding faults in the system. The

system should be tested experimentally with test data so as to ensure that the system works according to the required specification.

Levels of Testing:

The details of the software functionality tests are given below. The testing procedure that has been used is as follows

- Unit testing
- Integration testing
- Validation testing
- Output testing

Unit Testing

In this testing step, each module was found to be working satisfactory as per the expected output of the module. In the package development, each module was tested separately after it had been completed and checked with valid data. Unit testing exercises specific paths in the modules control structure to ensure complete coverage and maximum error detection.

The sensor unit was tested by connecting to the power supply and checking the output from the sensor with the help of an LED.

The transmit and receive module was checked by giving test data.

Integration Testing

Integration testing addresses the issues associated with the dual problems of verification and program construction. After the system has been integrated, a set of high-order tests were conducted. The main

objective in this testing process was to take unit-tested modules and build a program structure that has been dictated by design.

Software Integration

This method was an incremental approach to the construction of program structure. Modules were integrated by moving downward through the control hierarchy, beginning with the main programming module. The module subordinates to the main program module were incorporated to the main control structure.

Hardware Integration

All hardware units (which include power unit, data processing unit, and the sensor) were integrated on to a single board. After power unit was connected and hot tracing was done to verify the flow of supply through the circuit. The voltage level at each pin of the micro controller was checked.

Validation Testing

After the hardware and software have been integrated and tested separately the whole system was assembled and interfacing errors have been uncovered and correction tests were made.

Output Testing

Output testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently before live operation commences. The input system, output documents were checked and required modifications have been made to suit the specifications. Then using the test data prepared, the whole system was

FUTURE ENHANCEMENTS

9. FUTURE ENHANCEMENTS

The Project at present is developed to monitor a single machine. It can be further extended to monitor a set of machines. For this purpose, a DACS hardware interface along with a sensor unit should be attached to each of the machines. The output from these DACS should be integrated and sent to a single central PC.

Later a set of such systems can be integrated by networking the PC thus forming an Inter network of DACS.

CONCLUSION

10. CONCLUSION

The Data Acquisition and Control System is a useful system that reduces the cost of one person delicately monitoring and counting the components produced by a machine. Its features make it highly effective and compact system. This is an ideal system for automating the production in the industry.

It also minimizes the manual work needed to supervise production and counting to one shop floor supervisor for a set of machines. The supervisor need not go to each and every machine to supervise it.

The GUI based reliable environment is aimed to provide ease of operability and interactive ness. Since the entire operation is Micro Controller based any modification can be achieved through software, the hardware untouched.

REFERENCES

11. REFERENCES

Books:

1. John B. Peatman, "Design with PIC microcontrollers"
2. Rod Stephens, "Visual Basic Graphics Programming"
3. PIC microcontroller reference manual

Sites:

www.microchip.com

APPENDICES

12. APPENDICES

12.1 MICRO CONTROLLER FEATURES

PIC16F876 Microcontroller Core Features:

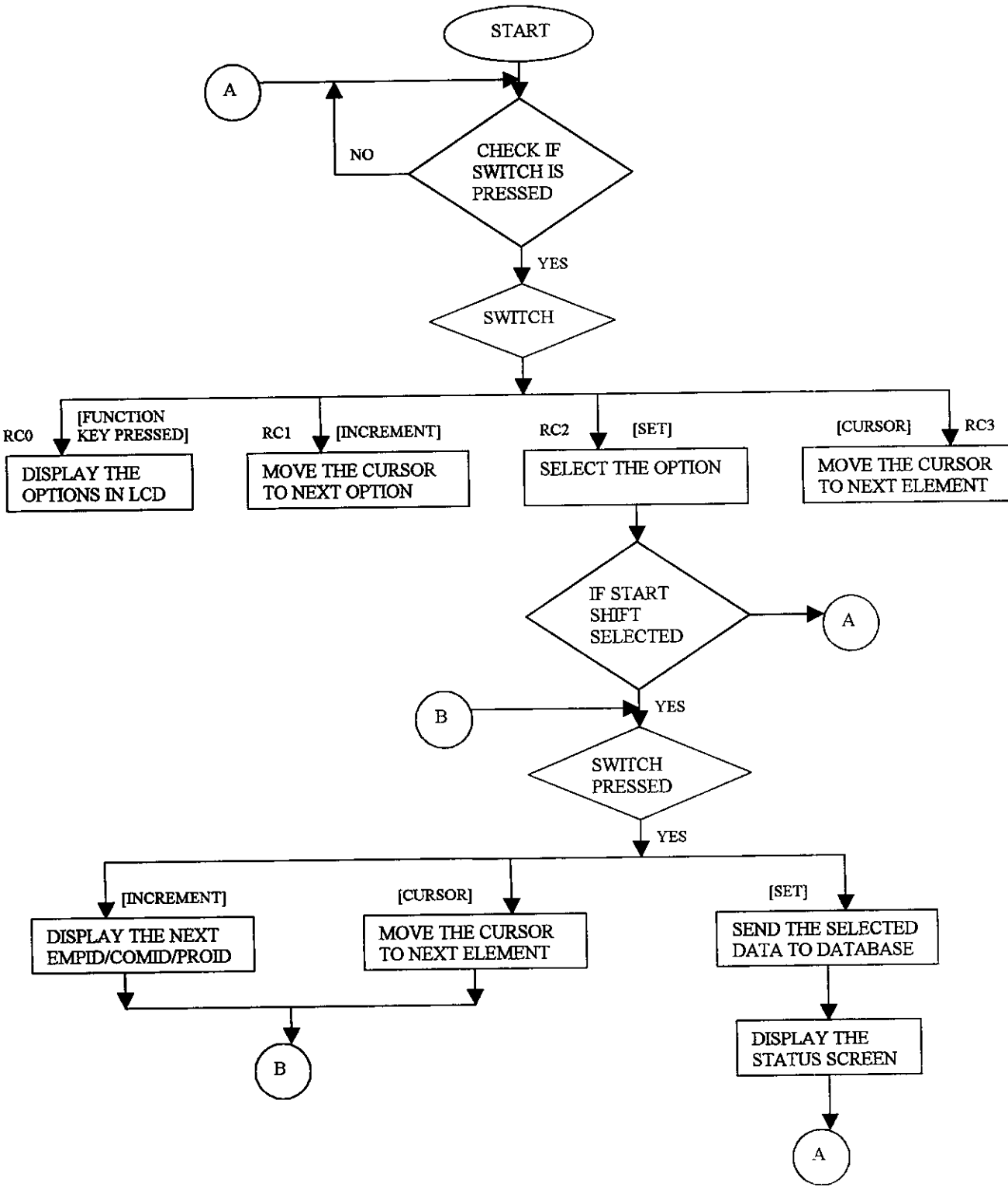
- High performance RISC CPU
- Operating speed : DC-20 MHz clock input
- FLASH Program Memory : 8 K
- Data Memory : 368 B
- EEPROM Data Memory : 256 B
- Power-on reset(POR)
- Power-up timer(PWRT)
- Oscillator start-up timer(OST)
- Watchdog timer(WDT)
- Power Saving SLEEP mode
- Wide operating voltage range : 2.0 V to 5.5 V
- High Sink/ Source current : 25 mA

Peripheral Features:

- Timer0 : 8-bit timer or counter with 8 bit prescaler
- Timer1 : 16-bit timer or counter with prescaler
- Timer2 : 8-bit timer or counter with 8 bit period register, prescaler and post scaler
- Universal Synchronous Asynchronous Receiver Transmitter (USART) for serial communication.
- I/O ports : Ports A,B,C

12.2. FLOW CHART

Operation of switches:



12.3. SAMPLE CODE

```
/*      lcd header file it contains all the necessary routine to initialize the LCD    for
control line porta 0-2 is used and port B for data lines        RA0 is for chip select and
RA1 for RW control and RA2 for enable lcdinit() must be called by the progrm which
includes this file*/

#defineRS      RA0
#defineRW      RA1
#define EN     RA2
void enable();
void busycheck();
void lcdinit();
void delaylcd();
void delaylcd1();
void clear_lcd();
void enable()
{
        EN=1;
        asm("NOP");
        asm("NOP");
        asm("NOP");
        EN=0;
}
void busycheck()
{
        EN=0;
        TRISB=0x80;
        RS=0; RW=1;EN=1;
        while(RB7);
        EN=0; RW=0;RS=1;
```

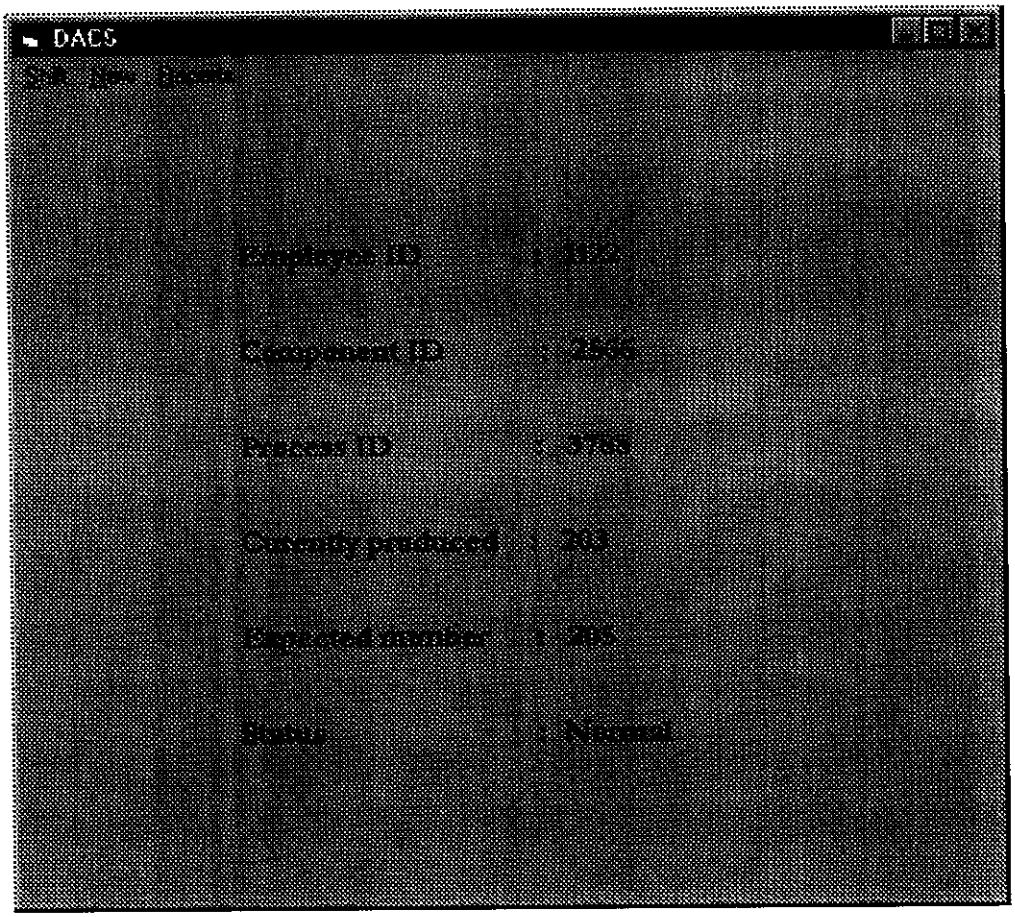
```
}
void delaylcd()
{
        unsigned int k=0;
        for(k=0;k<4000;k++);
}
void delaylcd1()
{
        unsigned int k=0;
        for(k=0;k<3000;k++);
}
void lcdinit()
{
        ADCON1=0X07;
        TRISB=TRISA=0;
        PORTB=PORTA=0;
        delaylcd();
        PORTB=0x38;
        enable();
        delaylcd1();
        PORTB=0x01;
        enable();
        delaylcd1();
        PORTB=0x06;
        enable();
        delaylcd1();
        PORTB=0x0f;
        enable();
        RS=0;
        PORTB=0x80;
        enable();
        delaylcd1();
        RS=1;
```

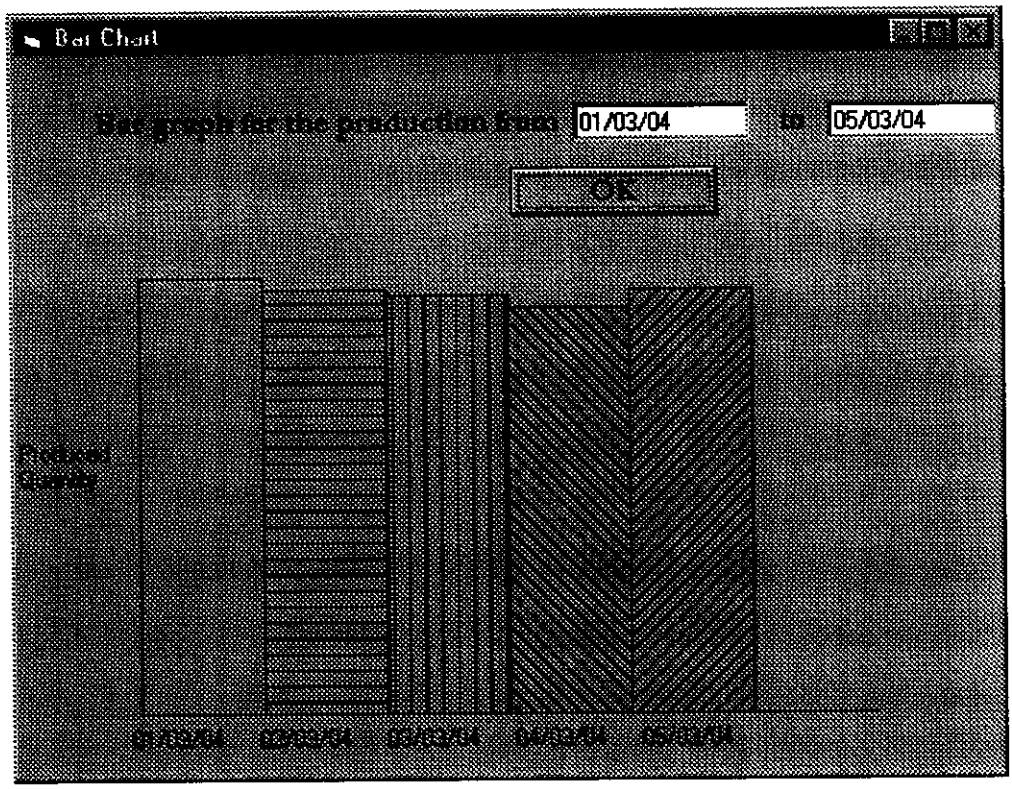
```
void clear_lcd()
{
        RS=0;
        PORTB=0x01;
        enable();
        delaylcd1();
        RS=1;
}
void lcd_display( char data)
{
                PORTB=data;
                enable();
                busycheck();
}
void main()
{
 lcdinit();
 }

 /* Timer 0 */
 #include<pic.h>
 unsigned int count=0;

 void main()
 {
        ADCON1=0X07;
        OPTION=0X00;
        T0CS=1;
        GIE=1;
        T0IE=1;
        TMR0=0x00;
        while(1);
```

```
}
void interrupt isr()
{
        if(T0IF==1)
        {
                T0IF=0;
                count++;
        }
}

/* Timer 1 */
#include<pic.h>
unsigned int count=0;
unsigned char sec=0;

void main()
{
        GIE=1;
        PEIE=1;
        TMR1IE=1;
        T1CON=1;
        TMR1H=0x00;
        TMR1L=0x00;

        while(1);
}

void interrupt isr()
{
        if(TMR1IF==1)
        {
                TMR1IF=0;
                count++;
```

```
            {
                sec++;
                count=0;
            }
            if(sec==60)
            {
                sec=0;
            // transmit();
            }
        }
}
```

12.4. SAMPLE SCREEN




Bar Chart
Bar graph for the production from
01/03/04
to
05/03/04
OK
Produced Quantity
01/03/04
02/03/04
03/03/04
04/03/04
05/03/04