

PROFESSIONAL TRAINING REPORT
AT
Sathyabama Institute of Science and Technology
(Deemed to be University)

Submitted in partial fulfillment of the requirements for the award
of Bachelor of Technology Degree in

Information Technology

By

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DEPARTMENT OF INFORMATION TECHNOLOGY
SCHOOL OF COMPUTING

SATHYABAMA
INSTITUTE OF SCIENCE AND
TECHNOLOGY (DEEMED TO BE
UNIVERSITY)
Accredited with Grade "A" by NAAC
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600 119

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BONAFIDE CERTIFICATE

This is to certify that this Professional Training Report is the bonafide work of Sivakumar G (Reg. No. 37120070.) who carried out the project entitled "Point Of Sale System" under our supervision from July 2020 to August 2020.

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DECLARATION

I am G.Sivakumar hereby declare that the mini project report entitled on “Point of Sale System” done by me under the guidance of Dr. P.Jeyanthi at Sathyabama Institute of Science And Technology, Semmancheri, Chennai – 600 119 and Mr. Sathish, Senior Embedded Engineer, LCS Controls PVT. LTD. is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in Information Technology.

DATE: 09-10-2020

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SIGNATURE OF THE CANDIDATE

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I am pleased to acknowledge my sincere thanks to **Board of Management** of **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

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ABSTRACT

This project is about the point of sale (POS) system Implemented in Embedded Systems, which is being done for the organization LCS Controls Private Limited. Point of sale is the point at which a customer makes a payment to the merchant after buying their product. After receiving payment, the merchant may issue a receipt or bill for the transaction, which is usually printed but can also be dispensed with or sent electronically. To calculate the amount to be paid by the customer for what he/she purchased, the merchant may use various devices such as weighing scales, barcode scanners, and cash registers, to control all these devices a microcontroller is used in hardware. The microcontroller processes all the input data given to it and output's the processed data to the required output console. To process those data, a programmer should give a proper algorithm to the microcontroller through any programming language which is accepted by the microcontroller. Ex. C, Python etc. In this project a proper algorithm is given to the microcontroller through C programming language, in order to solve the point of sale problem. The problem can be solved by getting data input to the microcontroller through various input devices such as weighing scales, Keyboards and output as a bill to the billing machine. This system is an integrated weighing point of sale (POS) system, such that the weighing scale measured weight for each item is directly displayed in the output screen. POS system enables quick product return processes. When a customer cancels a purchase, the merchant can process it through POS system with just a few clicks. The number of stock that was reduced automatically increases again once the purchase has been cancelled. The Accounting details of a grocery store can be stored in well organised manner, either it may be the tax amount or the total revenue collected by the store.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO THE COMPANY

LCS Controls PVT. LTD. is a service oriented company who are Designers, manufacturers and “end-to-end” total solution providers in industrial weighing, batching, bagging, packing and allied automation with a full-fledged manufacturing facility in industrial hub of Chennai, India. They also provide embedded electronics, mechanical items, electrical drives, material handling equipments, sensors & pneumatic actuators, real-time software etc.



Figure 1.1 : LCS Controls Pvt Ltd. Logo

1.2 INTRODUCTION TO THE PROJECT

The point of sale (POS) or point of purchase (POP) is the time and place where a retail transaction is completed. At the point of sale, the merchant calculates the amount owed by the customer, indicates that amount, may prepare an invoice for the customer (which may be a cash register printout), and indicates the options for the customer to make payment. It is also the point at which a customer makes a payment to the merchant in exchange for goods or after provision of a service. After receiving payment, the merchant may issue a receipt for the transaction, which is usually printed but can also be dispensed with or sent electronically.



Figure 1.2 : Sample POS System

In this project a suitable algorithm is given to the LPC1548/1549, an ARM Cortex-M3 processor to perform the task and to overcome the objective of Point of sale activity.

1.3 BACKGROUND OF THE PROJECT

This Project can differentiate each item through an unique identifier called item code. Each item has its own unique item code number and its quantity is measured in two types, one is weight and the other is pieces. Since, the memory size is limited POS System implemented in the LPC1548/1549 microcontroller can store data of 500 Items, 1000 bills per day and it's summary (max), most recent 2 months bill summary, most recent 2 years bill summary. Each Item entered for billing are stored as a backup at the spot which can handle power cut situation so that it can retrieve all previously entered items when power is back. The user is allowed to edit/delete the items that he/she entered. The weight is measured through the weight scale and it sends the analog data to the microcontroller, the microcontroller performs ADC operations and can determine the actual weight through calibrated values. The bill can be printed through a bill printer (i.e) connected using UART protocol with the hardware. A provision has been given to print the brief summary of today's bill, Monthly's bill, yearly's bill. The list of items and shop name are loaded into the hardware through a PC based software (Windows), detailed bill summary is retrieved from the hardware through the same software by storing it as a text file in the PC so that it can be viewed at any time. All the communications between the hardware and the pc will be serially at present through UART protocol.

CHAPTER 2

AIM AND SCOPE OF THE PROJECT

2.1 AIM OF THE PROJECT

The main aim of the project is to make an integrated weighing point of sale (POS) system, such that the weighing scale measured weight for each item is directly processed by the hardware to get the desired output and to make the billing process more faster. The Accounting details for any store can be stored in a well organised manner, either it may be the tax amount or the total revenue collected by the store.



Figure 2.1 : Single POS System

2.2 SCOPE OF THE PROJECT

POS solutions can lower the cost of doing business while increasing productivity, improving the bottom line. Upgrading from an Cash register to a point of sale system will result in a fast return on investment (ROI), both in rupees and time spent on day-to-day operations. As the days of analog technology continue to fall further out of use behind us, so do cash registers. Today, everything is digital, and everything is faster. POS systems will be simple for employees to learn, which will result in shortening training time and help them to be more productive overall. Point of sale systems have reporting features that allow to keep a close eye on sales, profits, and expenses like Cost of Goods Sold (COGS). POS reports give data in real-time, and formatted with easy-to-read information. It also helps streamline the accounting process. Old-fashioned cash registers force accountants to sort through hundreds of receipts, but with a POS system, you can print reports and, in many cases, import data directly with a suitable software.

CHAPTER 3

MATERIALS AND METHODS USED

3.1 LANGUAGES AND LIBRARIES USED

3.1.1 C Language :

C is a general-purpose, procedural computer programming language supporting structured programming, lexical variable scope, and recursion, with a static type system. By design, C provides constructs that map efficiently to typical machine instructions. The main features of C language include low-level access to memory, a simple set of keywords, and clean style, these features make C language suitable for system programmings like an operating system or compiler development.

3.1.2 C# :

C# is pronounced as "C-Sharp". It is an object-oriented programming language provided by Microsoft that runs on .Net Framework. By the help of C# programming language, we can develop different types of secured and robust applications:

- Window applications
- Web applications
- Distributed applications
- Web service applications
- Database applications etc.

C# is approved as a standard by ECMA and ISO. C# is designed for CLI (Common Language Infrastructure). CLI is a specification that describes executable code and runtime environment. C# programming language is influenced by C++, Java, Eiffel, Modula-3, Pascal etc. languages.

3.1.3 LPC1549 Header Files (C Language):

The LPC1549 LPCXpresso™ board with NXP®'s LPC1549 Cortex-M3 microcontroller is designed to make it as easy as possible to get started with the project. The LPC1549 header library has all the driver codes to make the code what engineer types compatible with the microcontroller.

3.2 SOFTWARES USED

3.2.1 Keil :

Keil MDK is the complete software development environment for a wide range of Arm Cortex-M based microcontroller devices. MDK includes the μ Vision IDE and debugger, Arm C/C++ compiler, and essential middleware components. It supports all silicon vendors with more than 7,500 devices and is easy to learn and use.

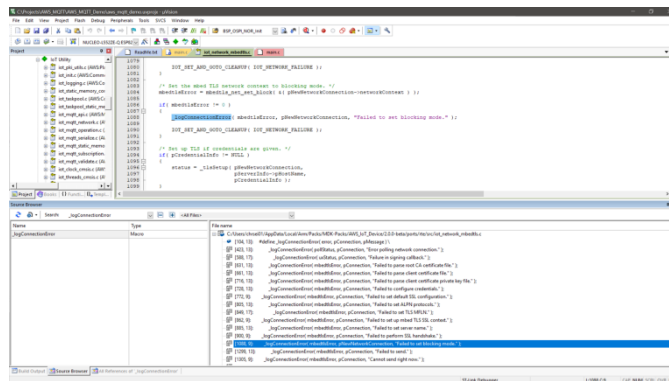


Figure 3.2.1 : Keil Software

3.2.2 Flash Magic Programmer :

Flash Magic is a PC tool for programming flash based microcontrollers from NXP using a serial or Ethernet protocol while in the target hardware.

3.2.3 Hercules Setup Utility :

Hercules SETUP utility is useful serial port terminal (RS-485 or RS-232 terminal), UDP/IP terminal and TCP/IP Client Server terminal. It was created for HW group internal use only, but today it's includes many functions in one utility and it's Freeware! With our original devices (Serial/Ethernet Converter, RS-232/Ethernet Buffer or I/O Controller) it can be used for the UDP Config.

3.2.4 Visual Studios 2010 :

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

3.3 MATERIALS/HARDWARE USED

3.3.1 RS232 Connector & Bill Printer (32 char) :

RS232 is a standard protocol used for serial communication, it is used for connecting computer and its peripheral devices to allow serial data exchange between them. As it obtains the voltage for the path used for the data exchange between the devices. Bill printer of 32 characters per line.

3.3.2 Weighing Scale :

A weighing scale (or weighing balance) is a device to measure weight or mass. One plate holds an object of unknown mass (or weight), while known masses are added to the other plate until static equilibrium is achieved and the plates level off, which happens when the masses on the two plates are equal. A spring scale will make use of a spring of known stiffness to determine mass (or weight). Suspending a certain mass will extend the spring by a certain amount depending on the spring's stiffness (or spring constant). The heavier the object, the more the spring stretches, as described in Hooke's law.

3.3.3 LPC1548/1549 MICROCONTROLLER :

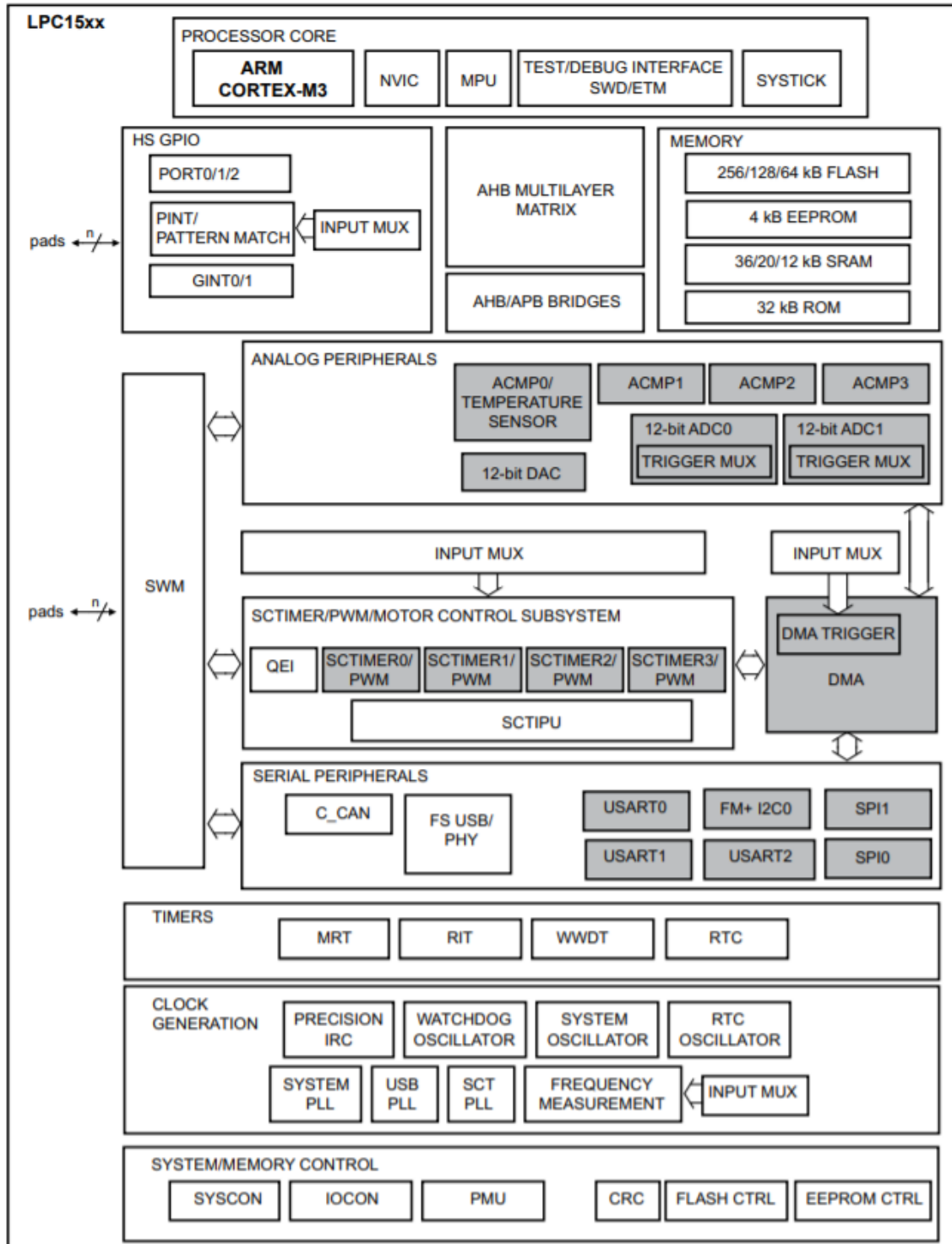
The LPC15xx are ARM Cortex-M3 based microcontrollers for embedded applications featuring a rich peripheral set with very low power consumption. The ARM Cortex-M3 is a next generation core that offers system enhancements such as enhanced debug features and a higher level of support block integration.

The LPC15xx operate at CPU frequencies of up to 72 MHz. The ARM Cortex-M3 CPU incorporates a 3-stage pipeline and uses a Harvard architecture with separate local instruction and data buses as well as a third bus for peripherals. The ARM Cortex-M3 CPU also includes an internal prefetch unit that supports speculative branching.

The LPC15xx includes up to 256 kB of flash memory, 32 kB of ROM, a 4 kB EEPROM, and up to 36 kB of SRAM. The peripheral complement includes one full-speed USB 2.0 device, two SPI interfaces, three USARTs, one Fast-mode Plus I2C-bus interface, one C_CAN module, PWM/timer subsystem with four configurable, multi-purpose State Configurable Timers (SCTimer/PWM) with input pre-processing unit, a Real-time clock module with independent power supply and a dedicated oscillator,

two 12-channel/12-bit, 2 Msamples/s ADCs, one 12-bit, 500 kSamples/s DAC, four voltage comparators with internal voltage reference, and a temperature sensor. A DMA engine can service most peripherals.

Fig 3.3.3: LPC15XX Block Diagram



3.4 METHODS AND ALGORITHM

3.4.1 Algorithm StartBilling():

STEP 1: Check if there is any previously entered items without billed, stored in E2 Prom.

STEP 1.1: If there Items exist read it and continue billing

STEP 1.2: If there is no item in the E2 Prom start billing newly.

STEP 2: Get the item code from the IBM Keyboard

STEP 2.1: if Item Count equals zero

STEP 2.1.1: If menu key is pressed do device menu operations like calibration, diagnostics, set date/time etc.

STEP 2.1.2: if F1 key is pressed show bill summary.

STEP 2.1.3: if F3 key is pressed provide tare weight operation.

STEP 2.1.4: if ENTER key is pressed in the IBM Keyboard show cannot print since no item is entered

STEP 2.2: If item code is invalid do not process and repeat **STEP 2**

STEP 2.3: If item code is valid show the Item description corresponding to that item code.

STEP 2.4: if the input key is ENTER from the IBM keyboard

STEP 2.4.1: Print the Bill, remove entered items from E2 Prom

STEP 2.4.2: Update Today's, Monthly's, Yearly's Summary.

STEP 2.5: if the input is F4 key perform edit/delete operation for corresponding entered items.

STEP 3: If that particular item is measured in terms of weight get the weight directly from weight scale.

STEP 4: If that particular item is measured in terms of pieces get no. of pieces from IBM Keyboard directly.

STEP 5 : if the input key is ESC Key from the IBM Keyboard, repeat from **STEP 2**

STEP 6: After pressing enter key in the IBM keyboard, store the Items to the E2 PROM, Repeat from **STEP 2**.

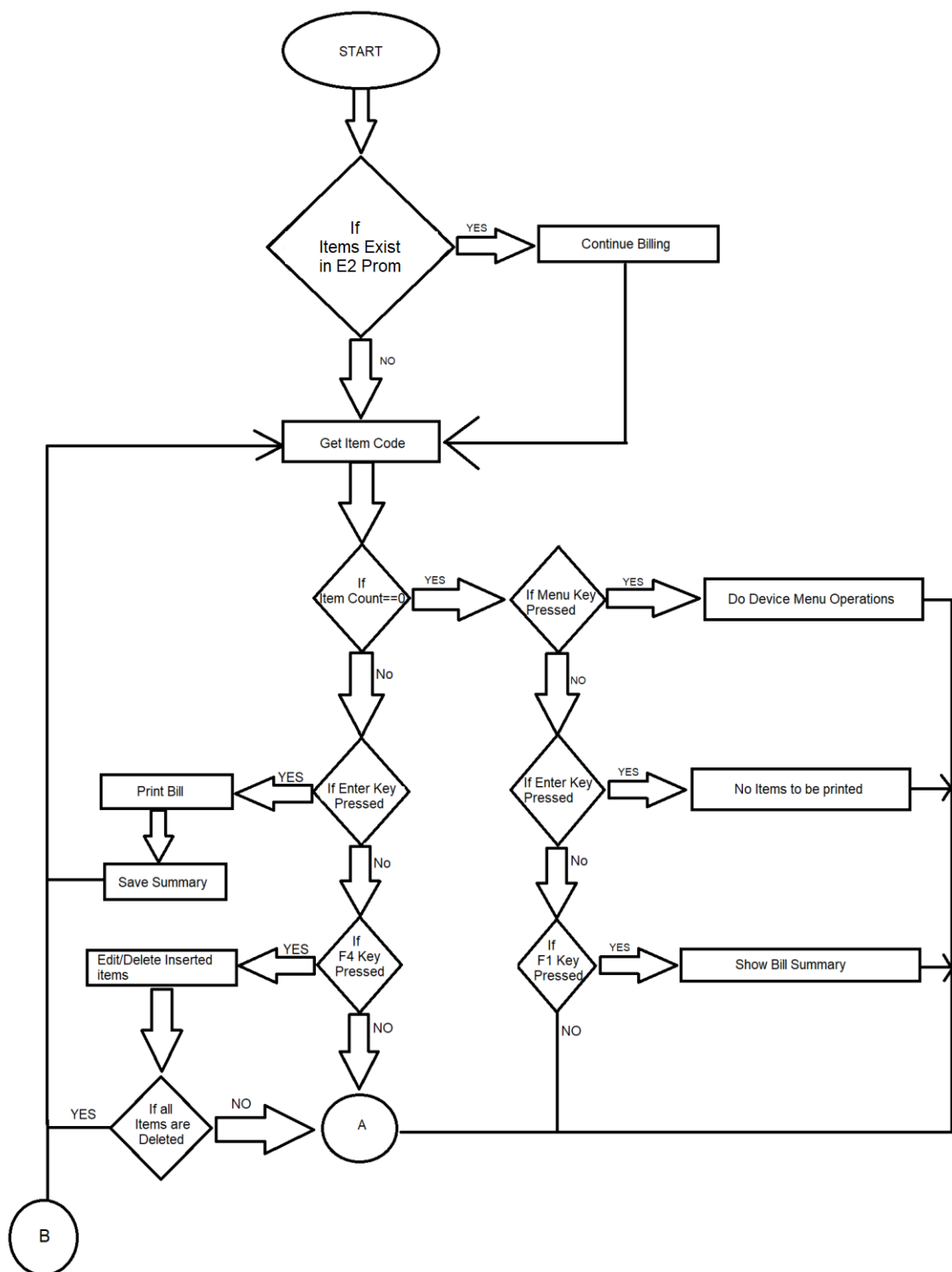
CHAPTER 4

CONCEPTUAL MODELLING

4.1 FLOW CHART OF THE POS SYSTEM

The below depicted is the actual flow of the POS system in this project implemented in the microcontroller.

Figure 4.1.1: Flow Chart



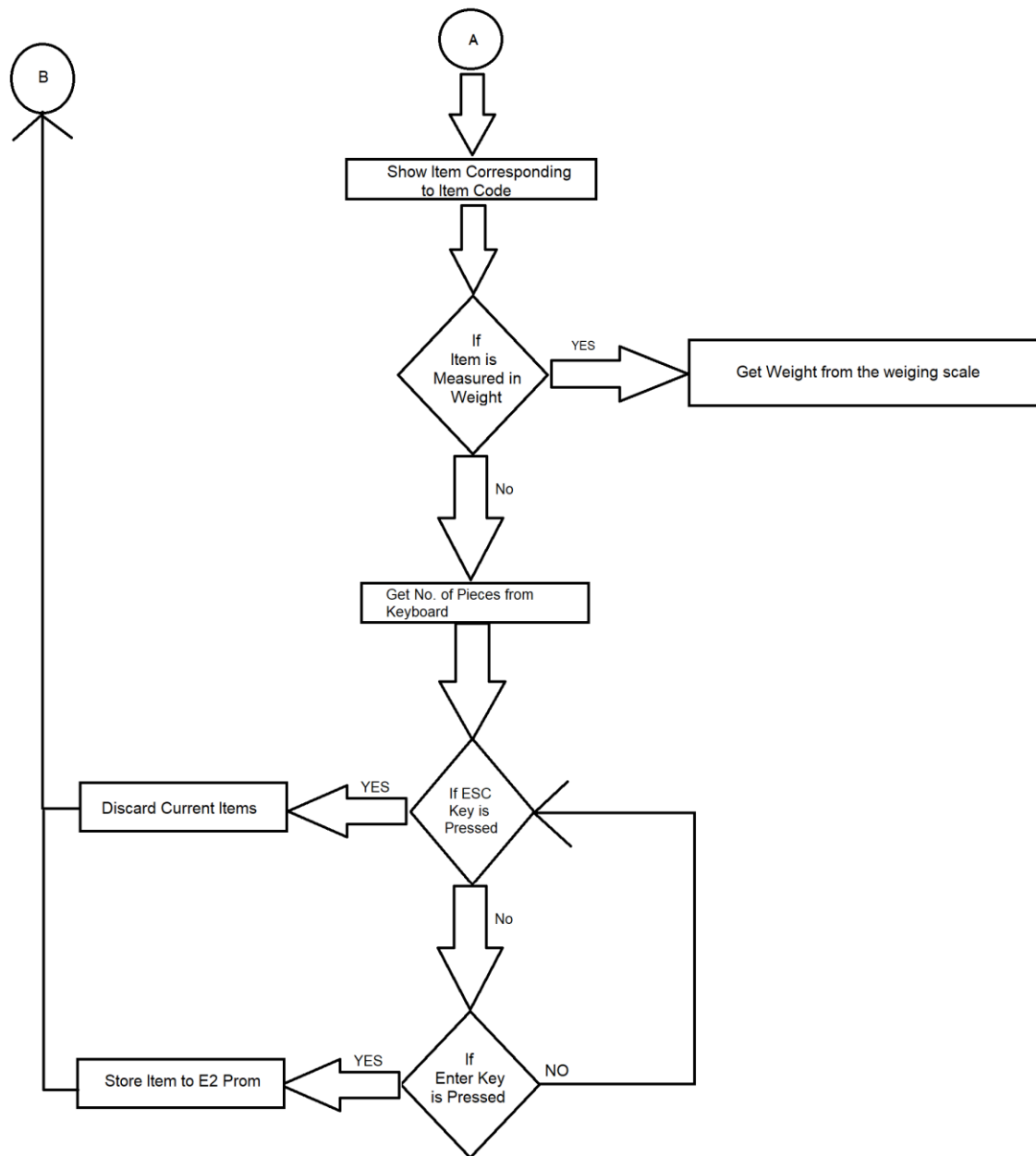


Figure 4.1.2: Flow Chart (Cont.)

CHAPTER 5

MEMORY MAPPING IN E2 PROM

5.1 E2 PROM

EEPROM (also E² PROM) stands for electrically erasable programmable read-only memory and is a type of non-volatile memory used in computers, integrated in microcontrollers for smart cards and remote keyless systems, and other electronic devices to store relatively small amounts of data but allowing individual bytes to be erased and reprogrammed.

5.2 E2 PROM ITEM BACKUP THAT IS ENTERED DURING BILLING

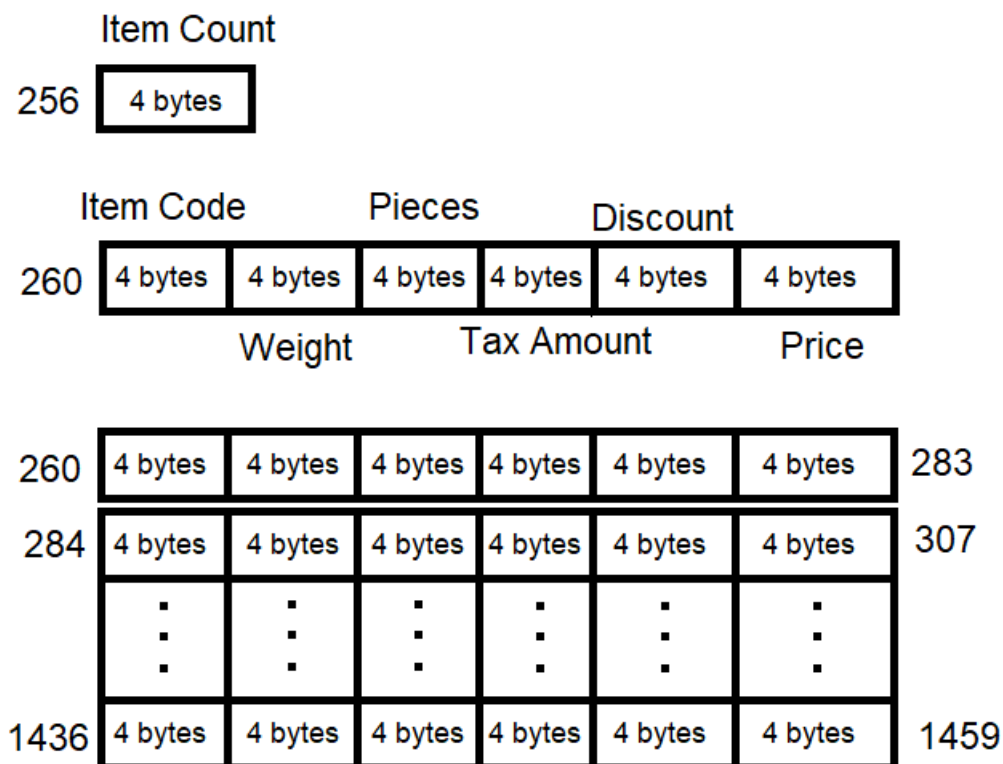


Figure 5.2: Item Backup Memory Map

The above memory map is for 50 items at maximum.

5.3 E2 PROM TODAY'S BILL SUMMARY

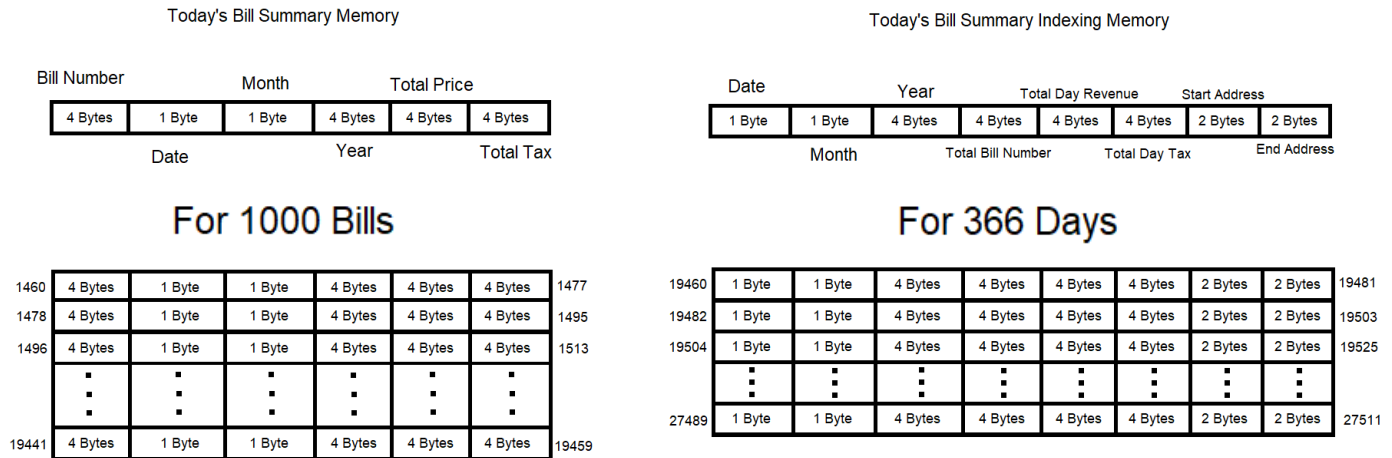


Figure 5.3: Today's Bill Summary Memory Map

The Indexing memory acts as an index to the Today's bill summary memory which can give a detailed bill report for a particular day. The indexing memory represents the starting and ending memory location of the bill report for that particular date. Hence, today bill summary memory can be used as a circular buffer to store daily bill report, so that memory is utilized efficiently.

5.4 E2 PROM MONTHLY'S BILL SUMMARY

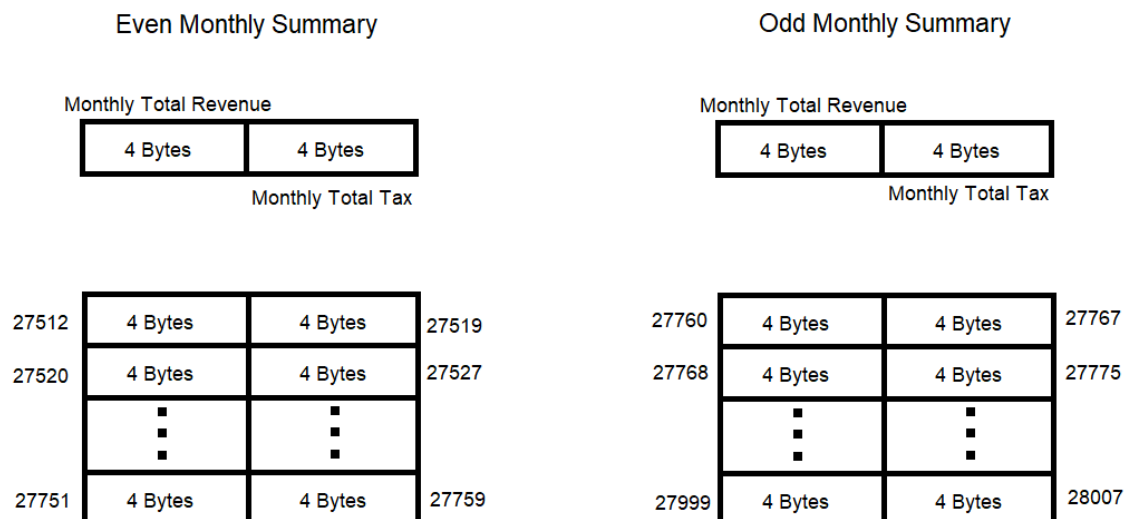


Figure 5.4: Monthly's Bill Summary Memory Map

The above memory map is done for two months of each 31 days assumed.

5.5 E2 PROM YEARLY’S BILL SUMMARY

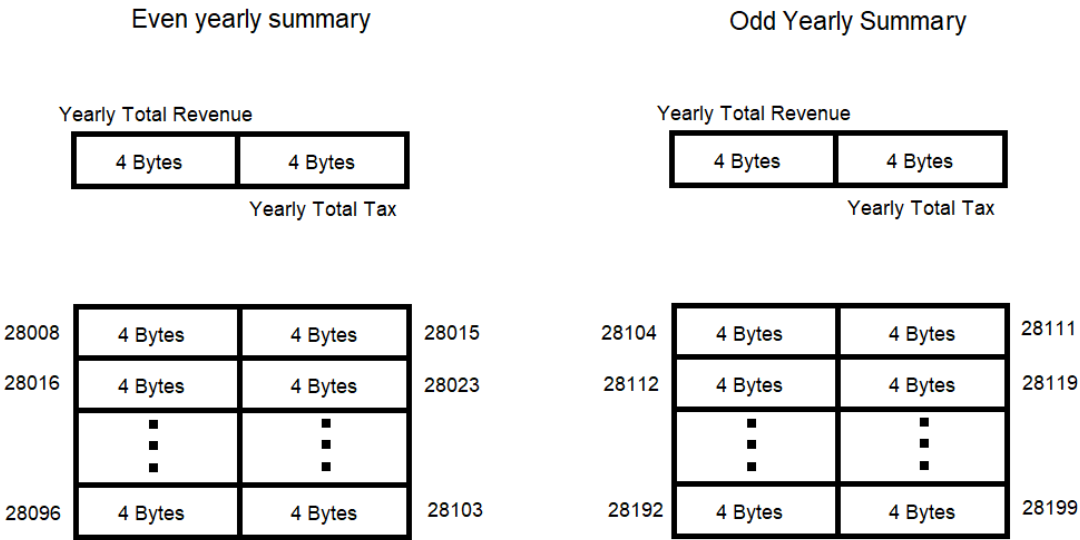


Figure 5.5: Yearly’s Bill Summary Memory Map

The above memory map is done for two Years of each 366 days assumed.

CHAPTER 6

OUTPUT / RESULT

6.1 RESULT

The project was tested with many real time inputs example Item code, weight through weight scale, number of pieces and got the expected output as efficient as possible.

6.2 INPUT



Figure 6.2.1: Input Data Example In Weight (KG)



Figure 6.2.2: Input Data Example In Pieces

6.3 OUTPUT

6.3.1 Bill Generated:

```

      HEADER1
      HEADER2
      HEADER3
      HEADER4
-----
08/10/2020 : 12:20:05
Bill No.    1
-----
Name          Qty  Price  Amount
-----
Tomato        4.11  38.50  158.24
RedBull        4    54.00  216.00
Semiya(1kg    5    60.00  300.00
-----
          Gross      :      674.23
          Coinage     :       -0.23
          Net Amount  :      674.00
Count : 3
Tax Amount :   30.39
You Save  :    6.16
-----
Thank You ! Visit Again !

```

Figure 6.3.1: Bill Generated

6.3.2 Brief Today's Bill Summary:

```

      Todays Summary
-----
Date   :   08-10-2020
Total  :   2866.00
Tax    :   105.02
-----

```

Figure 6.3.2: Brief Today's Bill Summary

6.3.3 Brief Monthly's Bill Summary:

```

      Monthly Summary
-----
Month  :   October
Total  :   2866.00
Tax    :   105.02
-----

```

Figure 6.3.3: Brief Monthly's Bill Summary

6.3.4 Brief Yearly's Bill Summary:

Yearly Summary		
Year :	2020	
Total :	2866.00	
Tax :	105.02	

Figure 6.3.4: Brief Yearly's Bill Summary

6.3.5 Detailed Today's Bill Summary:

DATE : 08-10-2020		
Total :	2866.00	
Tax :	105.02	
Bill Count :	5	

BillNumber	BillTotal	BillTax
1	674.00	30.38
2	216.00	16.00
3	11.00	0.00
4	516.00	16.00
5	1449.00	42.64

Figure 6.3.5: Detailed Today's Bill Summary

6.3.6 Detailed Monthly's Bill Summary:

Year : 2020		
Month :	October	
Total :	2866.00	
Tax :	105.02	

Date	BillTotal	BillTax
08-10-2020	2866.00	105.02

Figure 6.3.6: Detailed Monthly's Bill Summary

6.3.7 Detailed Yearly's Bill Summary:

Year : 2020

Month	BillTotal	BillTax
October	2866.00	105.02
TOTAL	2866.00	105.02

Figure 6.3.7: Detailed Yearly's Bill Summary

6.3.8 POS_DataTransmitter PC Software:

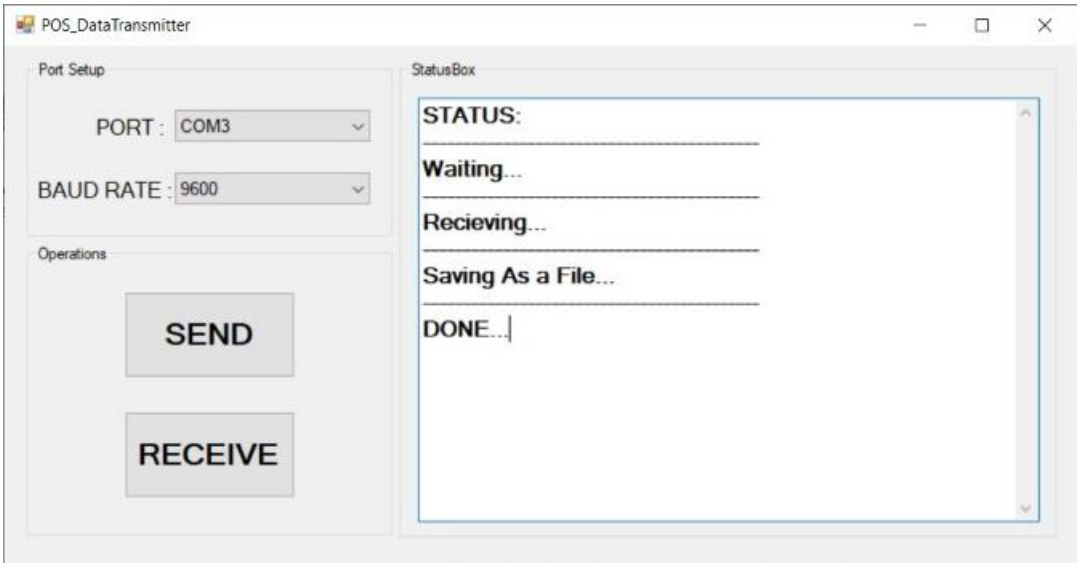


Figure 6.3.8: POS_DataTransmitter PC Software

CHAPTER 7

CONCLUSION

In this paper, the POS system implemented on the microcontroller LPC1548/1549 and making compatible with the awew 2000 device is explained with utmost perfection, as much as possible. This kind of Integrated weight POS system makes the usability more faster by making an user to stick their eyes directly to the product and the device rather than always seeing the weighing scale each and every time when a product is loaded.

This POS system can print reports and, in many cases, import data directly with a suitable software which makes the user to well structure their accounting details.

CHAPTER 8

REFERENCE

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3. <https://solutiondots.com/blog/point-of-sale-system/>
4. <https://www.investopedia.com/terms/p/point-of-sale.asp>.