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Raw Milk Collection Using Pos (Point Of Sale) and Gprs Technology

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Abstract
Dairy industry is largest industry in India which collects milk from farmers and produces different dairy products. As Agriculture is backbone of the country and dairy farming is major business for farmers, the proposed system will make this collection, billing process of milk from farmer to dairy more faster, reliable, accurate and less costlier. The proposed system contains POS (Point Of Sale) module and software running on it which includes in crane weighing scale withGPS / GPRS module. System is mobile so it can be carried out in vehicles like car, bicycle or trucks. The vehicle goes to individual farmer, farmer swipes their smart card, person collects milk by weighing it, generates the billing slip to farmer, and the data will be transferred to Centralized system using GPRS. Mean while centralized system will track the location of vehicle by GPS. The centralized system is able to locate the vehicle, make the changes in rates for billing.
IndexTerms—Electronic Weighing Scale, POS, Real time tracking,GPRS, GPS.

I. INTRODUCTION

Milk production in India is quadrupled in last 40 years, this mass production makes it world's largest milk producing country. The gross production of milk in 2011 was 127 million tons [1].This mass production is achieved using power of producer – owner and well professionally managed milk cooperative systems. The majority of farmers are illiterate or semi literate and they run very small part of this entire production. More than 15 million dairy farmers belong to various local dairy cooperatives which count upto 96000; they sell their products milk producer's organizations. Cooperative unions are supported by fifteen state cooperative milk marketing federations which will manage and control state wise milk production[1][2].

In 2011 everyday Amul collects around 9.10 million litres of raw milk (daily average 2009-2010) from over 13,328 village societies consisting of 2.9 million milk producer members. Its supply chain is easily one of the most complicated in the world. Amul is the largest food brand in India and world's Largest Pouched Milk Brand. This figure is only about Amul.

TABLE I. MILK PRODUCTION IN INDIA

Year	Production (Million Tones)
1991-92	55.6
2001-02	84.4
2011-12	127.9
Source: Department of animal husbandry,	

The primary source for milk providing to dairy is farmers. Dairy industries s a joint business of farmer who daily provides collected raw milk to dairy, dairy will provide the money according to milk collected. This process of raw milk collection happens twice a day. This collection process is very big and requires use of IT for easier, convenient and faster operation[1][2].

Milk collection process happens as Farmer pours milk from animals like cow or buffalo and brings pour milk in variety of containers and cans. A unique farmer ID number is given to each farmer. At MCC, The operator enters the farmer ID in the milk collection software & takes a small sample of milk for quality evaluation. It is evaluated by Milk Analyzer. It analyses parameters like SNF, FAT, added water & Temperature. The evaluated values are automatically taken by software for calculation and also displayed on the seven segment digital display so that farmer can view. Now Farmer will put milk into the Milk Can placed on weighting Scale. The weight is also displayed on the Digital seven segments Display. It is also automatically taken into the milk collection software. According to the rate chart based on various parameters, software calculates the rate for bring milk & finally a regional language printed receipt with all details like total amount ,total milk given with date and time is given to the farmer for reference and the payments.

This complete operation requires use of Computer at MCC and software to do the collection and billing process. The collected data are stored at

MCC can be transmitted to zone head office by using of Email or using Pen Drive.

II. CURRENT SYSTEMS

The present systems present in raw milk collections are either using Personal Computer or Data Processing Unit. Which is some what more costly and non portable [1][2].

PC based Automatic Milk Collection Unit(AMCU) at Milk Collection Center(MCC):

It comprise of following components:

1. Computer
2. Software
3. Milk Analyser
4. Electronic Weighing Scale
5. Digital Display
6. Printer
7. UPS
8. Battery

In this scenario milk collection done at milk collection center located in each village. Farmer has to bring raw milk to milk collection center. At milk collection center following process as below

1. Farmer has to collect raw milk from cow or buffalo.
2. Brings raw milk to collection centre. The farmer has given unique id, that id has to be entered into software.
3. The milk is weighed on electronic weighing scale and the weight of milk will be captured.

Figure 1.PC based Automatic Milk Collection Unit

4. Then the fat analyser analyse the Fat, SNF, Water parameters from collected milk by taking small sample of milk.
5. According to the parameters the price of milk is calculated.
6. The billing amount will be calculated and added to the database.

The system requires physical place to keep the system modules as all are large in size. System is not as such portable to move. Operation handler requires knowledge of computer for running system operation. System utilizesmore power. Power is consume by computer,printer, weighing scale and fat analyzer. Battery operation is difficult for the system as ruler area have more power failure problem in such scenario it's not much useful. UPS is solution for it but it'sa costlier solution. Its complete cost is around INR 120000[1].

Data Processor Unit based automatic milk collection system: In this scenario milk collection process will remains similar to the earlier scenario but Computer is replaced with the high end Data Processing Unit (DPU). Now DPU will communicate weighing scale and printer and fat analyzer. DPU will store data for the farmer information, billing details of farmer[2].

Figure 2. DPU based Automatic Milk Collection Unit

III. PROPOSED SYSTEM

Right now available systemsin literature are not much portable and are costlier. Available system will cost around INR 80000 to120000. The proposed system will incorporate small electronic crane scale with all required module so that it will be portable and less costly. The module incorporate printer, GPRS and GSM Module so it can read data from weight sensor and shows weight on display and also print the billing details.

The milk collector person will put this unit on vehicle with milk collection vessel. Now it will visit the farmer and collects milk. The unique id of Farmer is entered into machine and weight of milk is done. Billing slip to farmer is given and record has been stored. The collected data and location information is

transferred to centralized remote system using GPRS and the location data is collected using on GPS module.

This scenario will remove the man power required to collect and store the data in to centralized repository. The cost of system will be reduced drastically as all modules are combined together and it tracksthe vehicle in real time using GPS module on the system. System is now robust, more scalable, faster and easier operation. And also printing slip generated is in regional language so it is more usable and readable for farmers.

IV. PROPOSED SYSTEM ARCHITECTURE

The Physical System architecture for transferring data is illustrated in figure 3. The system architecture comprises of vehicles where the system is placed. The system architecture basically contains two modules: the system module and remote server module. System modules willcollect information, stored into itself and send data that is collected, location data to remote server.The remote server module is listening for the packet coming arrive to it. When packet arrives it will extract the information from it and store into database[3][4][5].

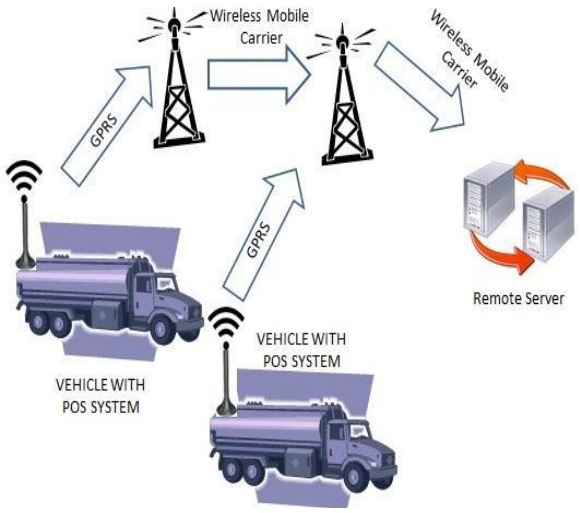

Figure 3.System Architecture for Data transferred

The vehicle will move and visiting each farmer location and collects milk. The System is putted on vehicle. Now the data is transferred from truck to the nearest mobile carrier through GPRS connectivity in packets. .Mobile carriers will now delivered these packets to the remote site. Remote site continuously waits for the packets, when packet arrives the data is extracted from it and is stored to the database and waits for the next packets[3].

The system module incorporate in vehicle contains the modules illustrate in figure 4 which are,

1. Microcontroller
2. Loadcell sensor and ADC
3. Display LCD
4. GPRS/GPS Module
5. 5 x6 Keypad
6. Thermal Printer
7. Real Time clock
8. Data flash Storage

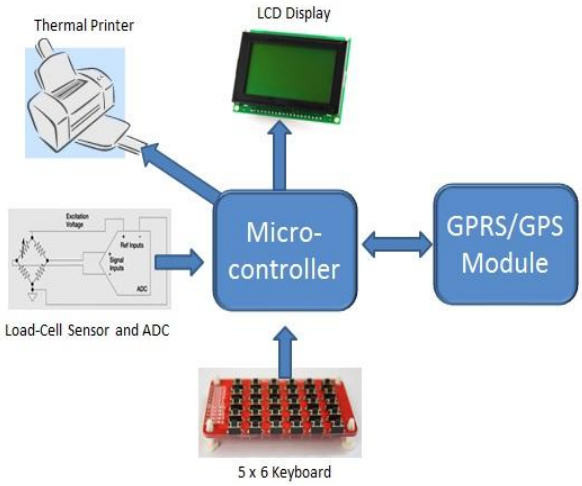

Figure 4.Detailed System design

The System module will initiate the LCD module initially by sending initializecommands required by GLCD. It will display home screen after initialization. After it will continuously monitoring the weight it will display on the LCD. When any farmer brings the milk to them at that time it will first weigh the milk then operator will put the farmer id using 5 x 6 keypad provided to it.When unique id is entered the details related to farmer are extracted from like farmer name, type of milk (cow or buffalo), total unpaid amount from the system database are extracted. Then the fat parameter has to be entered or it can be extracted through RS232 communication using external fat analyzer. Right now in system, fat parameters have to be entered by operator using keypad. Now system will calculate total amount based on the type of milk farmer brings, fat value of milk and weight of milk in liters. The total billing amount generated will be added into farmers account.The accounting details of total due payments, paid payments are also stored in machine. When the operator made a payment to any farmer according to that amount is deducted from his total due amount. There is also provision for selling other farming products like food for animals, fertilizer, food seeds to the farmers. The accounting and billing details data are retrieving back to machine when connected to software.

V. DESIGN OF POS BILLING SYSTEM

The system design of POS unit is a combination of weighing scale design, billing and printing module. The system uses silicon laboratories C8051F120 microcontroller as a system host, NAU

7802 ADC for weighing scale designing,Load cell as weight sensor,FM3164 Real Time Clock (RTC), Thermal Printer Mechanism, TM12864H6CCOWA 128 x 64 LCD for display information, AT45 DB642D flash memory and keypad.

Weighing scale design:

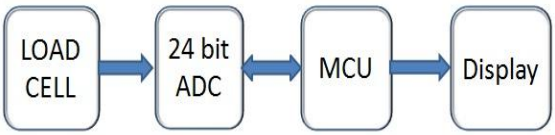

Figure 5. Weighing Scale architecture

Weighing scale design consists of reading data from load cell. Load cell is a transducer which converts forceapplied to it into an electrical signal. This electrical signal is very small need to be amplifying. Then thisamplified electrical signal will convert into digital form by ADC.Then this data is read by microcontroller and processed it and displays weight. Weight is converted into liter value according to the formulae [7][8].

Our system uses NUVOTON NAU7802 ADC for this weighing purpose. This will amplify signal and convert into digital form. It is precision low power 24-bit analog to digital converter(ADC).It has onboard low noise programmable gain amplifier(PGA) and RC crystal so no need for external crystal for clock. It has two channels out of which channel 1 is used to connect with load cell. GAIN of 128 is set for maximum amplification of input signal using microcontroller.Microcontroller uses SDIO,SCLKIO pins to interact with ADC, for settingdifferent parameters and reading data from ADC.

Silicon laboratories C8051F120 is 100 pin TQFP package with high speed 8051 core support up to 100 MIPS.It has 128KB code memory for program code and 8KB RAM. It has 8 8bit IO port and internal ADC.It will connect to all the modules and run the system.The programming for the system on this microcontroller will be done on KEIL C51 softwareand Hex file is generated based on codeformicrocontroller. Now the generated hex file will be burn on microcontroller using silicon laboratories USB Debug Adapter.

RAMTRON FM3164 is serial non-volatile memory and real time clock. It will provide real time clock data in binary coded format (BCD) toprocessor for keeping track on date and time.It communicates with MCU using I2C protocol using SDA and SCL IO lines of the IC.

Atmel AT45DB642D is 28 pin, 64MB dual interface Data flash used storing data and retrieve data from MCU.It supports for holding non volatile data for microcontroller.It uses 8 bit parallel interface for faster access and retrieving of data.Supports getting of next data or address while storing previous data.

TM12864H6CCOWA is graphics LCD consist of 128x64 dot matrix dots.it has single chip LCD driver NT75451 which can directly connected to micro-controller. It is black and white LCD so it will create black dot on white. It has 14 IO pins communicate. It has 8 bit parallel data interface with microcontroller.Microcontroller will display theinformation to user using this display.

Input keys in 6 x 5 matrixes, 30 keys for taking various different inputs form users.It will used totake user input like id, read values and other settings.

Thermal Printer Head mechanism consists of thermal print head without driver mother card. Its only head so the code for printing has to be given to this using 8 bit parallel port and control signals. It will prints the data based on data provide by Microcontroller.

The system uses Telit GM862 GSM/GPRS-GPS module.It is combined GPRS and GPS combined module.It also interacts with GM-862 GPRS/GPS module for sending data and location information to remote server. The GM862-GPS module has two 50 ohm micro miniature (MMCX) antenna connectors, one for the GPS antenna and the other for the GSM antenna. GM862 GSM modem with a frequency range of 824 ~ 960MHz // 1710 ~ 1990 MHz, and a GPS Antenna 3V Magnetic Mount SMA have been implemented. The system has been designed and tested experimentally using the developed circuit.

VI. PROTOTYPE RESULTS AND OUTPUT

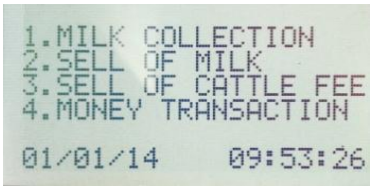

Figure 6. Snapshot of main display screen

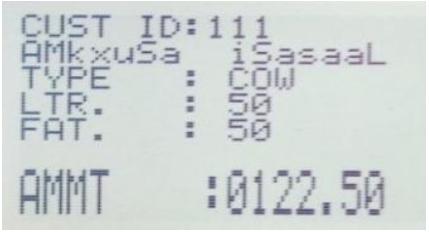

Figure 7. Entry screen

The Fig. 6 and Fig. 7 is two respective screen of display. Fig. 6 is main screen from where operator has to select type of operation. Fig. 7 is milk collection screen where user just entered customer id

"111" it will take the name and type of milk he supplies.

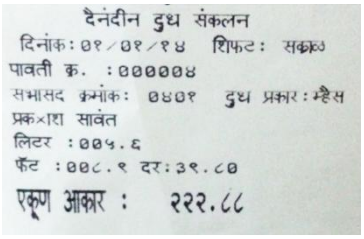
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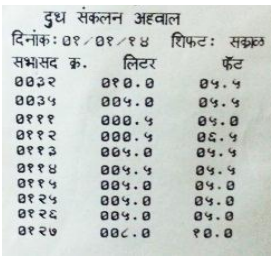
Figure 8. Milk collection slip in regional language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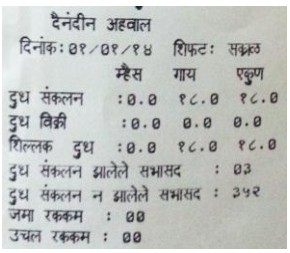
०११२	०००.५	०६.५
०११३	००५.०	०५.५
०११४	००५.५	०५.५
०११५	००५.०	०५.०
०१२५	००५.०	०५.०
०१२६	००५.०	०५.०
०१२७	००८.०	१०.०

Figure 9. Printed slip of Milk Collection Summery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दुध विक्री	:०.०	०.०	०.०
शिल्लक दुध	:०.०	१८.०	१८.०

दुध संकलन झालेले सभासद : ०३
दुध संकलन न झालेले सभासद : ३५२
जमा रक्कम : ००
उचल रक्कम : ००

Figure 10.printed slip of Daily milk collection Report

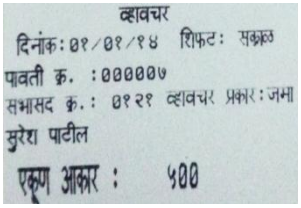
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Figure 11. Payment Slip

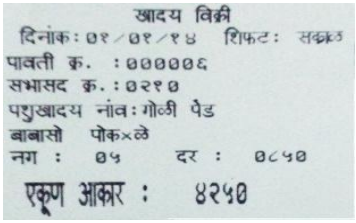
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Figure 12.Printed slip of Product Sell

Fig. 9 shows daily milk collected reports. Fig. 10 shows total milk collection report. Fig. 11 shows the payment slip of payment given to the farmer. Fig. 12 shows selling of other farming products to farmer.

VII. STRUCTURE FOR GUI SOFTWARE

Software design consists of GUI with database for transferring and retrieving data from billing machine.GUI is developed in Microsoft Visual Basic 6.Software is connected with MS Access database through OLEDB database connectivity.GUI is to make to transfer and retrieve data to or from machine. GUI is illustrating in Fig. 13.

Figure 13. GUI Application

VIII. STRUCTURE FOR GUI SOFTWARE

A.Cost effective: Theobjectives of the system are to be made cost effective is fulfilled. The system cost is reduced using making it as single module for all operations. The further cost is decreasing by single GPPRS GPS combined module so the cost of antenna and two separatemodules will be saved. Further printer head assembly is selected and drivers are implemented on the Printed Circuit Board (PCB) itself so the driver board cost has been saved.Single low cost microcontroller is selected to reduce cost drastically.For communication between all the modules RS232 is selected for GPRS, GPS and Software communication and parallel IO bus of microcontroller is used directly for printer and display. Small 128x64 TFT LCD display is select which also reduced the cost of high end display module. Weighing module is also on board so reduced the cost of external weighing circuit.So overall including all on the board reduced the cost of system drastically.

B.Highly Portable*:*The system is on now single module except fat analyzer. So system becomes highly portable.As the weight of system becomes around 3.2 Kg which includes all, makes system portable.

C.Manpower reduced*:* With GPRS connectivity System send the data to the server by GPRS module on the system,so the manpower required for collecting and storing data is reduced.

D.Avoids Data Tempering *:*As the weight is directly taken by system so notempering of weight can be possible. Earlier system mention in system can take weight from external weighing scale so the tempering of data is possible.

IX. CONCLUSION

In this paper, we have presented a cost effective,highly portable milk collection system using single module solution with GPRS and GPS connectivity for sending data to remote server.In future this system can also be modified and used for various collection processes. The improvement on GPRS that is uses 2G can be replaced by 3G and 4G for high speed. The prototype of system has been developed and tested successfully. It collects milk and stores the complete data into in to its memory and also send real time data and GPS location if GPRS connectivity is available, otherwise stores the data and send data to remote server later on when GPRS connectivity available. The System prototype is tested on single system module and remote server which handles the data.

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