Automatic Milk Collection Centre using GSM Module

Rajashri Narwade
Department of Electronics & Telecommunication
Saraswati College of Engineering

Yashika Singhal
Department of Electronics & Telecommunication
Saraswati College of Engineering

Suchitra Majumdar
Department of Electronics & Telecommunication
Saraswati College of Engineering

ABSTRACT
The Dairy industry in India is generally co-operative. The primary milk provided to the dairy is farmers who do not process their milk and give it in the raw form to the co-operative dairy. Since more number of farmers is depositing their milk in the dairy, it is a daily task of the dairy to assess the quality of milk from each farmer, verify it & meets the quality norms specified and make payments based on quality and quantity of milk. 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 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 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.

Keywords
Electronic Weighing Scale, GPRS, GSM Module Real time tracking.

1. INTRODUCTION
Agriculture is backbone of our country and dairy farming is joint business of Indian farmer. Dairies collect milk from farmer everyday & payments for this milk are done as per the rates per liter. This rate depends on various factors like weight, FAT, CLR & SNF of the milk. In earlier days, the process of testing of milk was done by measuring FAT, density, SNR, CLR and weight separately [5]. So, to measure each quantity is very time consuming and all farmers must stay in line for whole procedure. In milk collection process all the measurements are noted and calculation is done manually which further lead to mistake or error occurs during calculation. Hence the proposed work includes automatic milk collection system. Though several tests are available for quality assessment of milk like the content of protein, water, detergent, lactose, etc. but most dairies use only the fat content test and CLR (Corrected Lactometer Reading) to judge milk quality. [1]

Standard ranges of fat content and CLR of milk are specified by the government and it is necessary for the milk to satisfy this quality norms. In measuring fat content, we have used the principle of optical scattering of light by fat globules present in the homogenized milk. Thus, diverting totally from the usual method of separating the fat by burning it with acid, centrifuging it and measuring on a calibrated scale. In measuring the specific gravity of the milk or the CLR the basic principle of traditional method i.e. using a lactometer is preserved, but the observation of lactometer reading is made using electronics. Use of smart card is an additional feature of this project & each farmer is provided with a unique Id number.

The daily transactions for each farmer are to be stored on the internal memory as well as on a smart card of the farmer. A smart card reader is installed in the bank preferably near the dairy. So, they can withdraw his payment from the bank any time by producing his smart card in the bank. This smart card provision coupled with the portability of the

"Milk collection system" makes it possible to collect milk from those farmers who cannot take their milk to the dairy due to economical, physical, geographical constraints. The milk van equipped with the milk collection system and a weighing scale can collect milk from such farmers.

2. SIGNIFICANCE OF THE PROJECT
In dairy collection center time required for processing the milk is more as after procuring the milk from farmers at village cooperative societies it is then tested for the quality by measuring the FAT content, density of milk & quantity of milk. The proposed method will reduce the time and manual work, also sale of the milk will be increased. 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 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 and it tracks the vehicle in real time using GPS module on the system. System is now robust, more scalable, faster and easier operation. And printing slip generated is in regional language so it is more usable and readable for farmers.

3. PRESENT METHOD OF MILK ANALYZING

3.1 Fat Measurement using Electronic Milk Test
The instrument used to measure fat content instantaneously on a digital readout. It does not involve the use of corrosive chemicals. [4]

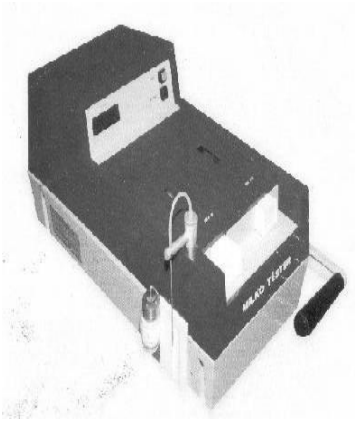

Fig.1 Milk Tester

3.1.1 Working Principle

Milko tester as shown in Fig.1 is based on the principle of photometric measurement of light scattered by the milk sample. The light is scattered by the fat globules present in the milk. The amount of light scattered by the milk sample is a measure of the fat content in the milk.

The milk sample needs to be homogenized before using it for test. For this purpose, 0.5 ml of milk is mixed with 6.5 ml of reactant solution. The reactant solution of 10 liters is prepared from EDTA (Ethylene Diamine Tetra Acetic acid) sachet powder (1 packet =52.6gms) + Antifoam (1.0ml) + emulsifier (Triton-X-100 =0.5ml). This solution is then made to pass through a syringe needle to disperse the fat globules homogeneously throughout the sample solution. Then this sample solution is introduced in the test tube and beam of light is passed through it. The more the fat content in the milk, more will be the amount of light scattered by the sample. Thus, the light reaching the photocell will vary with the fat in the milk. The change in current is displayed in terms of % Fat content.

3.2 CLR measurement

Lactometer is used to measure the density of milk. From lactometer reading we can find the water present in the milk. More is the density of milk less will be the percentage of the water. This instrument mainly contains glass tube containing mercury or lead shots at the bottom side of it.

The specific gravity of the milk is measured using a Lactometer. The Auto CLR is instrument incorporating electronics to observe the lactometer reading. Fig.2 shows the electronic CLR indicator & Fig.3 shows the CLR analyzer.

3.2.1 Working Principle

120 ml of milk is poured in cylinder the lactometer moves in a vertical direction and attains a fixed floating position. The lactometer reading is calibrated on scale on lactometer itself. Reading on the lactometer corresponding to the level of the milk gives the lactometer reading. But in Auto CLR we measure this vertical movement electronically. The upper tip of the lactometer is inserted in an encoder assembly. As the lactometer moves vertically then the encoder gives the output signal which is calibrated as a measure of the lactometer reading. This reading is given to the microcontroller which calculates the CLR.

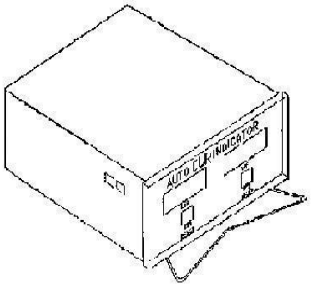

Fig. 2 Electronic CLR indicator

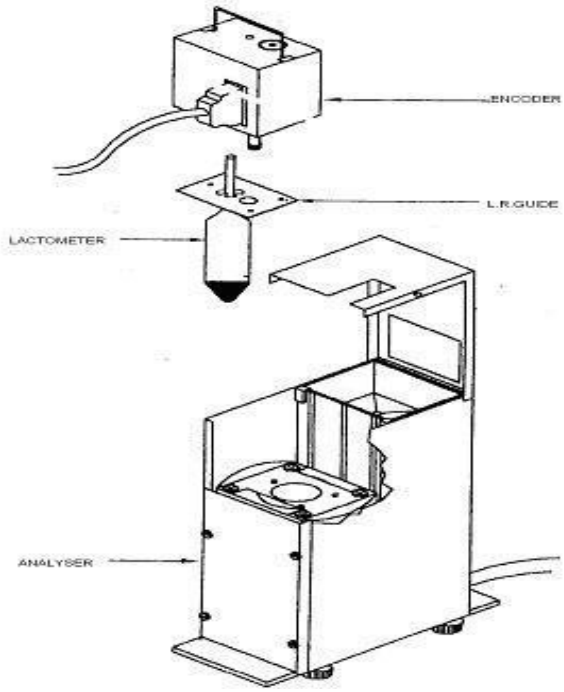

Fig. 5 DPU based Automatic Milk Collection Unit

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 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 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.

3.3 Weight measurement

When the farmers bring the milk at the Milk collection center then it is first weighed for payment depending upon the rates decided by the government. Following is the method used for weighing the milk. [4]

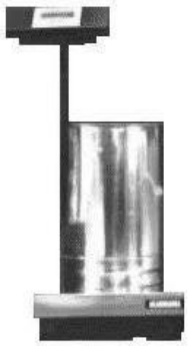

Fig. 4 Electronic weighing machine

In this method, an electronic weighing Scale is used. Farmers bringing their milk to the milk collection center where the milk is poured into metal buckets (aluminum or stainless steel) and weighed on an electronic weighing scale. The weight is displayed in liter or in kilogram (Since 1liter=1.03kg) on a digital LED display. Fig. 4 below shows the electronic weighing machine.

3.4 Proposed System

Data Processor Unit based automatic milk collection system: In this system milk collection process, will remains like the earlier scenario but computer is replaced with the high-end Data Processing Unit (DPU). [3] Now DPU will communicate weighing scale and printer and fat analyzer. DPU will store data for the farmer information, billing details of farmer shown in fig.5

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4. SYSTEM DESIGN

The Fig.6 shows block diagram of system and description of each block

1) Sensor block: The sensor block contains sensor assembly, which includes sensor for measuring weight, Fat and CLR of the milk.

2) Signal Conditioning: Signal conditioning circuit convert sensors output into standard form so as it is acceptable by microcontroller.

3) Micro controller: All the processing of the signal, storage, billing, and display is done by the microcontroller. The microcontroller used is PIC16F877, which is having RISC architecture.

4) LCD and keyboard: LCD and keyboard are connected to the microcontroller to display the result and to enter the data respectively.

5) Smart card connecter: Here a card is inserted to write the data on the smart card.

6) Real Time Clock: The real-time clock is used to log the data with respect to time & date.

7)GPRS and GPS: GPRS and GPS module is used for sending data and location information to remote server

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

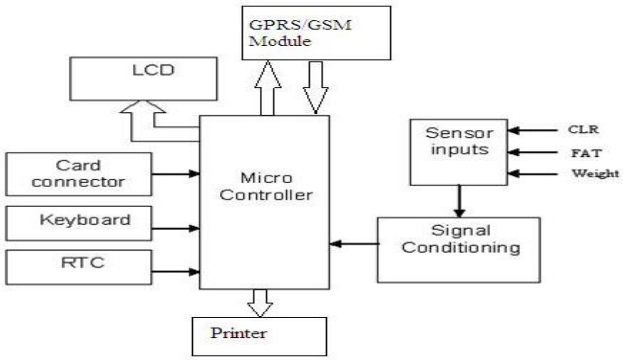

Fig.6 Detail System Design

4.1 Cash Counter

This section is totally based on the microcontroller as shown in fig 7. At cash counter when user insert the smart card in the slot provided on the card connector, microcontroller will read data from smart card and send it to PC, where the payment is calculated as per the predefined rate and data from the smart card.

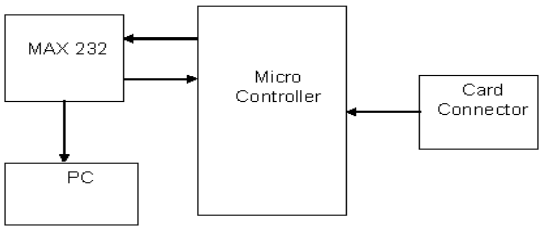

Fig.7 Block diagram of Cash Counter

Simultaneously, this total data can be displayed on the PC or we can take the printouts of the payment. The user can go anytime to collect his cash & once the payment has been given to the farmer the data from the smart card can be erased or next data can be overwriting on the smart card. The same data can be stored on the computer. We must make the database in the computer for the parameter. MAX 232 is used for the serial communication between microcontroller & PC.

4.2 Electronic Card

Smart card is simple memory card shown in the fig 8 below mainly used for the billing purpose. The day-by-day data will be stored on the smart card. User can go any time to collect his payment.

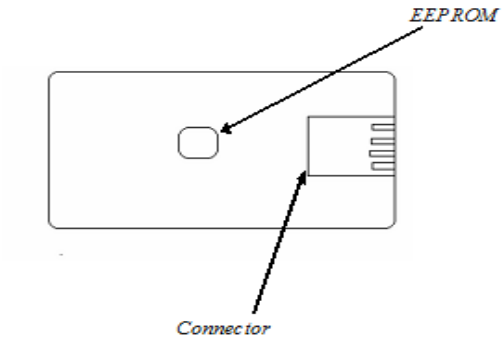

Fig.8 Electronic card

After giving payment we can vanish the total data on the smart card or we can overwrite the next record on the previous as per our requirement. Due to this memory, can be used efficiently. This card mainly contains flash memory AT24C04A for the data storing purpose. It stores the different parameters of the milk such as fat, CLR, SNF, total weight of the milk etc. for the user. Each user will have his own card. The AT24C04A provides 4096 (4K) bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 512 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24C04A is available in space saving 8-pin PDIP, 8-pin, 14-pin SOIC, and 8-pin TSSOP packages and is accessed via a 2-wire serial interface. In addition, the entire family is available in 5.0V (4.5V to 5.5V), 2.7V (2.7V to 5.5V), 2.5V (2.5V to 5.5V) and 1.8V (1.8V to 5.5V) versions. Here for our application we use 8-pin SOIC AT24C04A. Fig. 8 below shows electronic card on which a serial EEPROM is mounted.

4.3 Proposed System Architecture

The Physical System architecture for transferring data is illustrated in fig.9.

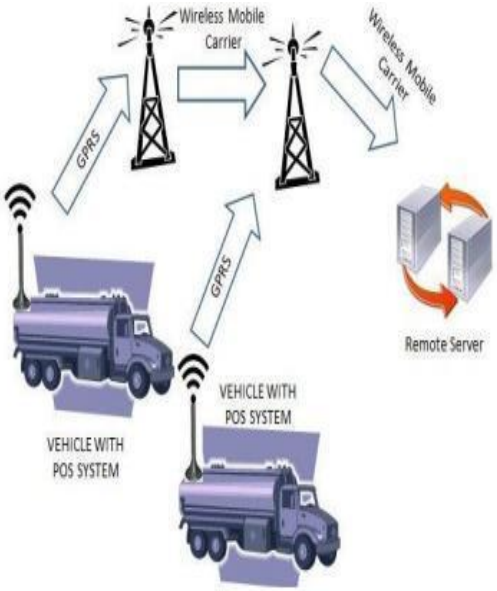

Fig. 9 System Architecture for Data transferred

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 will collect information, stored into itself and send data that is collected, location data to remote server. [3] 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. 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 deliver 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. The System module will initiate the LCD module initially by sending initialize commands required by GLCD. It will display home screen after initialization

After it will continuously be 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 should be entered or it can be extracted through RS232 communication using external fat analyzer. Right now, in system, fat parameters should 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 as per that amount is deducted from his total due amount. There is so 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.

5. CONCLUSION

This paper, presented a cost effective, highly portable milk collection system using single module solution with GPRS and GPS connectivity for sending data to remote server. It collects milk and stores the complete data into in to its memory and send real time data and GPS location if GPRS connectivity is available, otherwise stores the data and send data to remote server later when GPRS connectivity available. 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.

6. REFERENCES

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