Nat. Volatiles & Essent. Oils, 2021; 8(5): 2987-2994

NVEO
Natural Volatiles &
Essential Oils

Automated Cow Management System

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Abstract-

The cowshed maintenance for both small scale and large scale enterprise is a tedious process. Because maintenance involves many processes like feeding, cleaning, health care, protection. To do this process a huge manpower is required and it will take more time. This paper proposes a method to automate the activities related to the cow management. It aims to monitor the cowshed and reduces the presence of the human all the time with the help of SCADA. To automate this process LOGO PLC has been used.

Keywords*: SCADA and LOGO PLC*

I. INTRODUCTION

In developing countries like India people use man power for cattle feeding and cleaning the shed. To do these activities daily, a huge amount of manpower is required. In manual feeding, the farmer must distribute the food to the cattle and pour water to the trough. The trough needs to be cleaned before refilling with fresh food, It requires more manpower and high time consumption. For cleaning a small cowshed, it takes nearly an hour and for large cowshed it takes huge time. As the size of the cowshed increases, number of workers required for this process also increases. So, the owner of the cowshed must spend more money for cleaning and feeding process. Cattle owners who are away for a long time will have trouble knowing the situation of feeding cattle. To overcome these problems, this project deals with automated feeding and cleaning process.

The maintenance cost of cow shed is high, as it requires more men and time. Cleaning the cow shed as well as feeding the cows are cyclic operations. The cows have to be fed thrice a day and the cowshed can be cleaned at regular intervals of time. These processes do not require any special supervisors, so when they are automated, the efficiency will be higher. This project will be a boon to the owners of the cows.

The prototype of Automated Cow Management system developed shows the detailed working procedure of feeding and cleaning process in the cowshed. Nowadays automation grows very rapidly in various industries and also in other fields. This work uses PLC to automate the feeding and cleaning process. The main goal of the work is to design and build a prototype of an Automated Cow Management System. After the automation, time consumption and manpower requirement problems will be solved.

II. LITERATURE SURVEY

Additional works that are similar to this study is discussed

A. Literature Review

Dr.K.Renganathan, et al [1] have explained how food and water feeding and cleaning processes are automated with the help of PLC and monitored using SCADA. The smart management and generation of electricity from Gobar gas produced from the wastes collected in the tank is also done.

Harshal P.Patil, et al.[2] has given some ideas in addition to the food and water feeding, shed cleaning, cow cleaning, fencing alarm process and fire safety which includes details on how to protect the cows from the fire accidents. Here also PLC is used.

P.S.Raghavendran, et al.[3] explains the system which uses a conveyor belt to distribute the food to the desired location, but only one box can be filled with food at a time. For feeding a single cow, entire conveyor has to be moved all the time and it is controlled by a microcontroller.

Pratiksha Karn, et al.[4] has given some ideas about automatic cattle feeding system in a robotic feeding system which consists of a battery-operated vehicle which is capable of feeding equal amount of food. The feed is manually loaded in the feeder and follows the pre-determined route until it reaches the destination.

Mohamed samer et al.[5] gives the overall idea for monitoring of equipment required for cutting the food from the field and delivering to cows, automatic and robotic milking barns are given, which automate the feeding and watering systems.

J.Thilagavathy, et al.[6] discusses some concepts apart from the feeding systems - the health of the cattle is also important. This paper provides health monitoring system of RTC, GSM module which alerts the farm owner to check the cattle periodically. Here temperature control system is used to maintain a moderate temperature (39°C) in the cow farm.

Anne Grothmann, et al.[7] presents survey taken from big farms which are located in various countries. The data collection in this paper shows that an automatic feeding system can be installed not only in big farms but also on small ones. Graphical model for time taken by an automatic feeding

B. Outcome of the Literature Survey

From the literature review, the clear idea and the different methods which are used to automate the feeding and cleaning process in cow shed has been gained. After a detailed literature review based on need, it is proposed to use a PLC to automate the cow farm. The PLC has the required number of inputs, outputs and timers which are required for the timely feeding of the cows and to keep the maintenance schedules. The robustness of its design to perform in harsh environment is another reason for selecting the PLC.

III. PROPOSED SYSTEM

It takes a lot of effort to keep a cowshed and cows in good condition. The aim of this work is to reduce the workload of cattle owners by automating the process of feeding cows and cleaning

cowshed. The focus is to develop a prototype of an Automated Cow Management system. The overall configuration of this project is provided by the prototype design. Fig 1 depicts the software design model of the prototype in progress.

This design gives idea for doing the prototype. In this design the required components are taken from the wizard application in the software. The components used for design are water tank, food container, conveyor, small tanks, motor, pipes, valves and some other required shapes. These components are assembled in the windows maker and separate tag names are assigned.

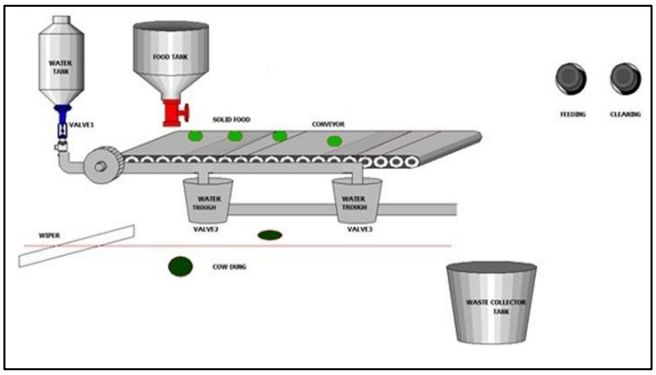

Fig. 1 Software design of Prototype

IV. HARDWARE COMPONENTS REQUIRED

A. PLC Logo

Fig. 2 PLC LOGO (courtesy)

PLC LOGO! in Fig. 2 is a simplified version of PLC. This LOGO consists of 8 digital inputs, 4 digital outputs and 400 blocks of memory. The program can be stored externally using standard micro SD card. It requires 24 V DC input supply and the output relays are potential free.

B. SMPS

Fig. 3 SMPS (courtesy)

SMPS (Switch Mode Power Supply) in Fig. 3 is used to convert high power AC voltage to low power DC voltage. It converts 240 V AC supply to 24 V DC supply which is required for the project.

C. Speed Controller

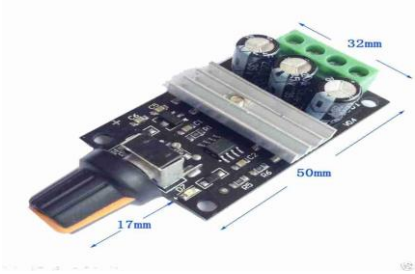

*Fig. 4 Speed controlle*r (courtesy)

Fig. 4 shows speed controller used to control the speed of DC motor at a required rpm. It has an input of 24 V and speed can be controlled manually or through a controller.

D. DC Motors

Fig. 5 DC Motor (courtesy)

As the output of LOGO PLC is 24V, hence the 24V DC motors as shown in Fig 5 was used in conveyor and wiper. DC motor has high speed and high torque, to control this speed controller is used.

E. Solenoid valve

Fig. 6 Solenoid valve (courtesy)

This solenoid valve is also 24V operated and is shown in Fig. 6. Once the signal is triggered from relay in the plc logo, the solenoid valve will open. This valves are used for controlling liquid flow and gas. This valve allows minimum amount of water flow when the tank is at minimum height. It is normally in closed position, when it is triggered it become open.

F. Terminal Blocks

Fig. 7 TBs (courtesy)

TBs in Fig.7 are used to make series connection for outputs i.e. if one output is taken from plc logo then it is connected in series to make multiple outputs. Fuse TBs are also available, but in this project normal TBs are used for making many connections.

G. Lead screw

Fig. 8 Lead screw (courtesy)

To transform rotational motion into linear motion, a lead screw as in Fig. 8 is employed. In this project wiper is used to clean the cow dungs, because of that wiper requires linear motion. Hence the wiper is attached to the lead screw for linear motion. Lead screw used in this project is 30cm length.

V. SOFTWARES APPLIED

A LOGO soft comfort

This software consists of many components for making the required logic and installation process. After creating the logic, the simulation part is done with the help of this software. This software is used to create a logic with the help of ladder diagram and functional block diagram techniques. For this project ladder diagram technique is used. In this work, the ladder diagram method is used to develop ladder logic which is suitable. Here, the weekly timer is used for the specific interval of time between the processes. The objective is to transfer ladder logic to LOGO, hence PC to LOGO option is used. In LOGO the program can be edited, but it takes time. Once the ladder logic is uploaded, then the LOGO can be RUN at any time. After the interfacing of PC and LOGO, the ladder logic is transferred to LOGO. Blinking of light in the LOGO indicates that it is ON and the program is in RUN mode. After data transferring, the data is stored in the LOGO PLC and it can be used at any time. Fig. 9 shows the LOGO soft screen used to program the prototype.

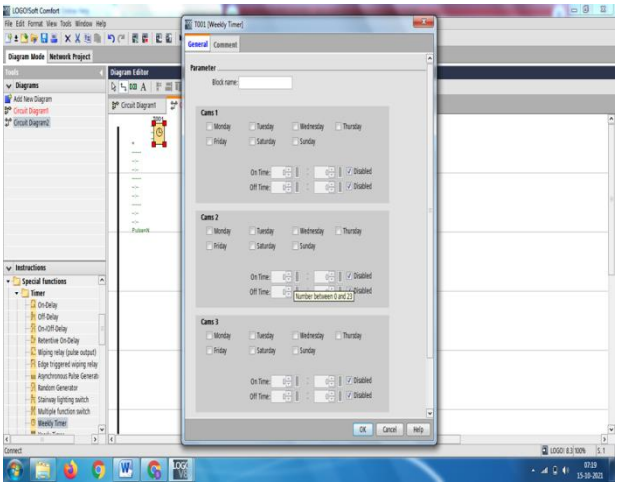

Fig.9 Ladder logic in LOGO soft comfort

B. Wonderware InTouch

Wonderware InTouch is a SCADA software which is mainly used in industries for screening and controlling many processes from one place. Intouch is a SCADA software, which is used for making simulations and monitoring facilities. Windows maker is used to assemble the required components from several functions. The windows maker screen, which is used for making the full setup before the simulation setup. Windows viewer is used to view and simulate the required or assembled components.

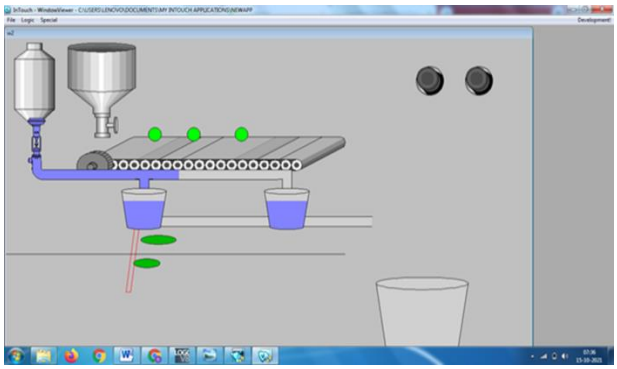

Fig.10 Simulation using Wonderware intouch

VI. HARDWARE ASSEMBLY

All the required components are purchased and assembled. First wooden base with plain surface of required size is placed. The wooden base is mainly for the protection of electrical components from short circuiting, because when it is placed on the normal ground it may get short circuited.

TB is assembled closely and placed at one side of DIN rail. PLC LOGO and SMPS are placed at the other side of DIN rail. Then the input of SMPS is wired from the 240V plug and gives the output of 24V. As the 240V is harmful to human beings, for the safety it is converted into 24V with the help of SMPS. The output of SMPS is connected to input of PLC LOGO, because the LOGO is 24V operated. And then output of PLC is wired to TBs seriously and the output is potential free.

Then the DC motors are placed on the base and tightened with clamps and screws, this is because to avoid the vibrations. The rotating motion of the motor is converted to linear motion via a lead

screw. One end of lead screw is connected with DC motor and other end is fixed with bearing attached clamp.

Wiper is attached with the lead screw for cleaning the base, when the motor is in running mode. Then pipes are connected from water tank to trough and then to wastewater collector. At the end of these pipes, solenoid valves are connected to control the flow of water.

First feeding process begins, in that water from water tank is collected in the trough and the solid foods are placed on the conveyor belt. Then for cleaning process, water from the trough is collected and food on the conveyor is moved to waste collector by the movement of DC motor. Fig. 11 shows the prototype developed for the purpose of demonstration of the proposed system and was functional

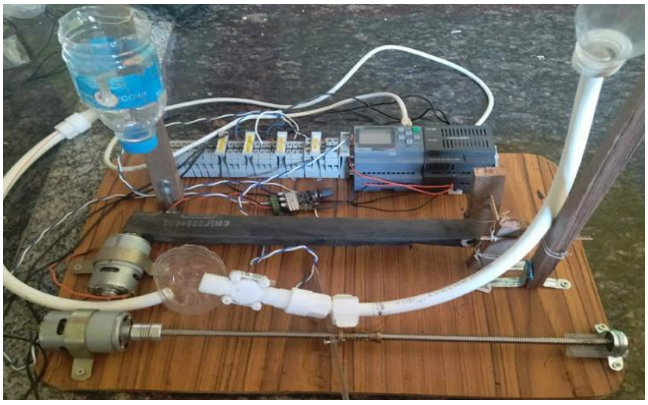

Fig. 11 Prototype developed for demonstration.

VII. CONCLUSION

The main objective of the work was to develop a low-cost automated cow management system prototype automated using LOGO PLC in the view of feeding and cleaning process, which are exactly done in real time cow management system. The design and development of automated cow management system has been successfully completed.

The given task of developing a low-cost prototype has been completed within the given period. While going for real time, the factors and parameters which are chosen would help in great as the simple demonstration with smaller prototype has been shown successfully. Moreover, the technologies involved in this prototype are adaptable to any kind of cow management system

The future development of the work will be identifying the cows with the help of sensors and then food can be delivered to specified location. Further android app can be developed to know the level of food in the container and can be operated from remote location.

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