University of sharjah

Nutrition, Healthy Food

University of Sharjah Industrial engineering and management Department 0405324: Simulation Term: Spring 2010/11 Automated Milking system Done by: Israa Abulawi U00010793 Rawan Abulaban U00011154 Directed to Dr. Imad Alsyouf 12/17/2011 Executive Summary: Our Project is About the Automated Milking System in AlAin Dairy Farms in UAE, we focused on the Milking time and the Production of milk , we tried to implement suitable modifications for the process to improve the production of milk . In our project we studied the milking time , number of milking cycles for all cows in farm, and the milk production so that we could apply all concepts taken in the course for optimizing the milk production. Using the help of ARENA software and many useful articles related to the topic we reached to the conclusion that the AMS that the farm was using wasn't the optimum , and many other types are more suitable related to the large herd on the farm. Applying the Stochastic system simulation course principles to a real life application helped enhance our knowledge of the course , and Choosing this topic helped us to learn about a new process . The report will represent how the system of Alain dairy farms work and the modification that we suggested in order to improve the course. Table of contents. Executive

Introduction:

Imagine a world of your own, where time and space under your command. A

world where you can do anything, and there are no mistakes or wrong

answers. The only limits are your imagination; this is the world of modeling

and simulation. Al Ain Dairy is committed to leading the way as a responsible

and ethical company operating in the community. Al Ain Dairy has developed

a comprehensive program of corporate social initiatives and is committed to

the conscientious use of sustainable environmental resources. Their vision is

to be recognized as the preferred choice of dairy products of households in

the Emirates and their mission is to maintain a tradition of excellence in

customer service, to lead the dairy industry in milk innovation and to offer

consumers a wide variety of high quality safe products at affordable prices.

Automatic Milking system (AMS), it has been the topic of discussion for some

time now, but as they become increasingly popular, we are looking at just

how effective automatic milking machines are and evaluate their benefits.

The Advances of automatic milking systems is to remove some of these labor

demands, while at the same time serving to augment overall farm

productivity and profitability. Typically one AMS can handle between 3200 to

3400 cows dependent on several factors such as : * Facility layout and

design. * Management philosophies. * The degree of automation employed

when combined with the average production per cow across an entire herd.

Problems to be solved and objectives of the Project: we are studying the automated milking system of the farm (parallel milker) , starting from the time the cow entered the system to the time it exits it . The farm has approximately 3600 cows and they are brought in batches of 120 to get milked in the designated milking time before every wash-up, the milking time of 5 hours is a very long time which doesn't leave lots of time for cow proper feeds and rest time . Machine is utilized in a duration of 5 hours approximately , and is shut down only during the wash-up hours . Based on the data collected from the farm we have established a Model that represents the system and we suggested system modifications , the run of both simulation models (original and improved) Gave results that showed that the improvements on the original system were successful and showed improvements in milk production. We would like to thank Eng. Patrick O'Dawyer For taking us on a tour all around the farm and factory and providing us with necessary information . Theory: Trying to understand the correct way to approach the project, it was wise to first look in a number of published articles that will help us in analyzing our project properly. Doing research on the required topic " Automated milking systems in dairy farms", allowed us to understand what we are dealing with in more depth . A lot of articles related to the matter showed that the automated milking system is a reliable, dependable system that has a labor- saving efficiency and very flexible. It's about providing the producer with more freedom to manage his/her own time. At the same time, the producer and helpers, instead of being immersed in the milking process, can now spend more time observing and supervising, and managing the herd, instead of getting trapped in the

rush to complete a scheduled milking. The Data that Can be obtained When applying an Automated Milking System are " real" time data results that shows what's happening as the cow enters the milking process, Also these data will help in herd management and consider many sources of improvement around the farm . There are various questions to answer regarding milking parlor in general: * What is the desired milking routine? The amount of time required to perform the pre-milking work routine on each cow determines the number of milking units and milking stalls that one each operator can use effectively. If you want excellent milking routines (teat and udder sanitation, effective stimulation, appropriate prep-lag times) practiced in the parlor, it must be sized to encourage the desired outcome. A parlor that is too big will encourage the operators to take short cuts and not implement the complete milking routine. A parlor that is too small will result in bored workers and early unit attachment. * Who will be operating the parlor? The skill level and motivation level of the people in the parlor will determine how efficiently the milking routine will be implemented. * Will the parlor be used as a place to provide special treatment to cows? Some parlor types are more suited to providing individual cow care than others. such as the rotary parlors. * What is the expected production level, milking interval and cow grouping strategy? These factors will influence the average amount of time that milking units stay on cows. Short milking times lend themselves to smaller parlors. * What sort of work environment do you want to provide for the operators? Some parlor types allow the use of support arms for milking units and milk hoses and some do not. Support arms offer several advantages for both people and cows. Support arms carry the weight of the

cluster and hoses so that operators do not have to. This reduces considerably the strain on the shoulders and lower back of the operators. Even weight distribution on each quarter is also easier to achieve and promotes even milk-out while reducing the number of slips and unit falloffs that occur during milking. Many performance Measures are considered in Applying AMS : 1- Machine Utilization : Number of milking per unit, sometimes measured as liters harvested per machine per day. Idle time per machine per day is also used as an indicator of machine utilization. 2- Milking Frequency : Number of times a cow is milked per day. Helps decide if the herd is on track to achieve production targets. Farmer can set machine to allow/deny milking for individual cows based on factors like stage of lactation or production level. 3- Milking interval : Numbers of hours between milking for each individual cow. Not necessarily a whole number and will vary from day to day and between cows. Interval too long — drop in production, increase risk of mastitis. Interval too short milk yield too low and potential for poor attachment with flaccid udder and low milk harvesting rate (yield per minute). 4-Visitations of selection units and milking units : The frequency and timing of cow visits to the dairy. This information is captured by the software and can be used to identify cows failing to meet milking frequency targets or to monitor machine utilization. system description: The Data: * Al Ain Dairy Farms has an average Milk Production of 150, 000 liters per day. * 44 liters per day per milking shift . * 30 milking cycles . * 2 milking unit , one with a capacity of 80 cows , 40 cows per lane and second with a capacity of 40 cows , 20 cows per lane. * 120 cows enter both milking units at same time in both milking areas. * They Produce 44 liters/milking shift(8. 5-9minutes). * 4

times Daily. * Number of cows they have on the Farm is 3600 cows. * 20 hours of milking per Day. * 4 hours of Wash-up. * Time for cow in system is 8. 5 mins-9 mins. * Pressure pump (pulsator) stops milking if flow of milk is less than 0. 5 liter/30 secs the Process : The Model : This is a basic simulation model that we have built to implement the real system . first we have defined the CREATE module to represent the cow arrival into the system with entities per arrival of 120, and max arrivals 30 which represents 30 milking cycles, then we used the ASSIGN module to keep count of the number of cows entering the system using the variable type , variable name countcows with a new value of countcows+1, we have used the HOLD module to express the waiting time for each batch of cows with a condition of max number of cows that enters the system does not exceed 120 (countcows>== 120), Then the process module was used to represent the milking process with UNIF(8. 5, 9) which is the milking time per cow, the second ASSIGN module (Amount produced) counts the number of milk that is produced, then the DISPOSE module shows leaving system and terminating simulation process. Input analyzer : By using Input Analyzer and Generating new using Poisson distribution with mean 120(number of cows that enters the system as a batch out of 3600 cows in total) , and 3600 data points (total number of cows in farm) . The results were good and by applying fit all Poisson distribution was also the best fit for the data with square error that is very small = 0. 000231 , and corresponding p-value that is greater than 0. 1 (p-value= 0. 7). Normality test of First Model : using the Normal distribution and after applying fit all normal distribution was best fit for a mean of 120 and SD of 10. 1 for 3600 data points. After testing the Normality of the first

model the results were acceptable and the square error was small = 0. 000250 , and the corresponding p-value = 0. 223 which is greater than 0. 1 . Model results : Run : Number In= Number Out = 3600. Number of Replication= 4 Replication Length= 10 for 4 replications : After running the system for 4 replication the number Out = 3600 which represents that the system, number of cows that enter the system equals the number out , Covered the milking process of all cows on the farm , and the average amount of milk per cow (AvgAMTPerCow)= 10. 79 liters , and The total Amount produced of milk during each 5 hours cycled 38, 877 liters . Proposed Solution: the performance measures of this process is not entirely bad but the problem was the parallel milking system was taking too much time to milk such a large herd so the milking process takes a lot of time and the station does not fit a large capacity which consumes more time of the day on the milking process and other tasks such as herd management , supervising, managing , and cow feeding and health and rest is only done during a small part of the Day. That's why if the farm changes the facility layout into a Rotary milking Parlor it would be better, and many reasons are stated : * The advantage of the rotary parlor is that: * the cow movement functions are largely automated, freeing the operators to tasks more directly associated with milking. * Rotary parlors typically require three operators: one for unit attachment, one to detach units and/or apply post milking teat dip and one to tend to any problems occurring while cows are traveling around (reattach units, tend to liner lips, etc.). * rotary parlors are best suited to larger herds (> 1000 cows). * One advantage of a rotary parlor is that the work routine very regimented and uniform. * Milking procedures will

in general be much more consistent and efficient in a large rotary parlor than in an equivalently sized parallel parlor. Some disadvantages: Rotary parlors usually use a ' face-in' configuration and are subject to all of the same disadvantages of a parallel milking parlor. It is more difficult to provide any special cow care on a rotary platform than a stationary parlor. This parlor type is not expandable. And the capital cost is usually higher per stall than for non-moving parlors. Because of these characteristics. Model Improved: Now using the same processes that are used in the first modeling of the system , the processes will remain the same but the entities and data entered is different : A Rotary Milker can process much larger numbers of cows at once , because it is built according to how many cows are on the farm , it could be built with 100 to 800 stalls as long as the space is available the number of stalls are not an issue . New Data: Batch of 600 cows enter system at once. The milking time is the time from when the cows enters the system till it exits , by the time the cow finish one loop (turn) that is the milking time and since we assumed that the stalls fit 600 cows then the process will take about 8 to 10 minutes . The entities per arrival at this process are 600 and the max arrivals are 6 , which represents 6 cycles of milking per day . The condition used in the hold process was set to capacity does not exceed 600 cows (countcows>== 600). After running this system for 4 replications also we obtained the following results in the statistics report : which is the same number out for the first original model, which represents the number of entities that must enter and leave the system. Regarding the milk production , since the cows spends more time in the system and the milking time is more than the first model more yield

production of milk increased slightly as shown in the following results obtained from the report : Improved From38, 877 to 39, 951 litres. Output analyzer : The total amount of milked produced was compared in both models(Original, Modified) on the output analyzer , we went to the statistic module in the advanced processes and saved a data file(. dat)in the output file and entered them to the output analyzer, we add a new file >> ADD, select data files and check their Confidence Interval or half widths as following : from these results we can see that there's differences in the averages and standard deviations of both models but to insure that these models are verified we must compare their means as following : Using 95% confidence interval, the results obtained shows that the systems are verified and built correctly and that the logicality of the model does represent the real system . since the zero was displayed on the right side meaning that there's improvement or increasing in the process , which is the increase in milk production. null hypothesis is rejected , which states that means are not equal so theres improvement in the process . Summary : Rotary milking parlor does not affect the quality of milk , does not need many operators around the milking area (labor-saving), its better for the farm since their herd size exceeds 1000 cows , and its more suitable for their process because it allows more time for maintenance and wash-up of machines , they have the time to enlarge their herd if they wish to since processing time(milking time) is not 5 hours a day anymore , milking cycles dropped from 30 cycles to 6 cycles a day which is a huge performance improvement, they have more time on hand for herd management and to deal with feedings and the health of the cow itself which will also yield to

improvements in milk production. Since the cost of setting-up a Rotary milking system is a bit high , it is still beneficial on the long run and there are many other areas of cutting cost on a dairy-farm such as : * Energy management On the surface, utility costs may seem small in comparison to feed and other items associated with dairy farming; however, if left unchecked, using energy inefficiently or unwisely generates unnecessary costs that can quickly add up and impact your bottom line. * Lighting efficiently Lighting can account from 15% up to about 24% of electricity costs on a dairy farm. Learning how to use lighting effectively and efficiently not only can help trim your utility costs, but it can also improve working conditions and cow comfort. Normality test of improved process : since p-value is greater than 0. 1 and square error is small= 0. 000248 .... validated model. Normality test results were acceptable and shows that the model is valid with the square error small = 0. 000250 , and corresponding p-value = 0. 223 which is greater than 0. 1. The Model Modified : *Process While running with counting of amount and number of cows. This is a basic simulation model that we have built to implement the real system . first we have defined the CREATE module to represent the cow arrival into the system with entites per arrival of 600, and max arrivals 6 which represents 6 milking cycles, then we used the ASSIGN module to keep count of the number of cows entering the system using the variable type , variable name countcows with a new value of countcows+1, we have used the HOLD module to express the waiting time for each batch of cows with a condition of max number of cows that enteres the system does not exceed 600 (countcows>== 600), Then the process module was used to represent the

milking process with UNIF(8, 10) which is the milking time per cow, the second ASSIGN module (Amount produced) counts the number of milk that is produced, then the DISPOSE module shows leaving system and terminating simulation process. Number In= Number Out= 3600 Results shows increasing in the milk production due to more time available in system . Validation and Verification : relying on the results of Output and input analyzers , the results were all acceptable and represents that the system is correct and mimics the real system on the farm. All corresponding p-values related to both processes are acceptable and greater than 0. 1, and all square errors were too small , which shows that the results are verified and correct. Output analyzer results showed that there's a mean Difference between Both Model, and since the zero shows on the right side from the Blue Line it shows increasing in the milk production as we desired , By analyzing those results we can say that the system did work and does mimic real system and we have achieved our initial goal in increasing the milk production. Conclusion: Modeling and simulation is used everywhere you look from moves to games, cars, and possibilities are endless. This report has demonstrated how arena simulation system works. A lot of people use it because it's very useful, it generates a lot of information and it improves the system. Introducing cows to any new system like automated milking system can be successfully to the animals. Farmers must let the automatic system have the chance to have faith and to learn that cows will adopt. The automatic milking system is not a substitute for good management; it is a essential that all normal preventative measures are maintained in respect of mastitis control cow reproduction and health. Refrences : * Broom, 1988 D.

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