Nano Sensor Empowered Livestock Monitoring System Using Golden Section Optimized Recurrent Neural Network IoT Platform

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As of now, accuracy in Cow Monitoring Systems (CMS) are picking up much importance in dairy farm. These frameworks permit to screen dairy animal's health, the ideal opportunity for insemination,rumination and the birthing procedures so called parturition. Doing as such, they can possibly minimize the work and the labour costs while expanding milk yield as suggested by Silent herdman survey of database available on Cloud assited IoT devices . Constant innovations in the field of IoT have opened numerous new open doors for observing animals and have been accelerating the improvement of CMS frameworks. When structuring an IoT-framework, regularly different mechanical choices are accessible by mapping the practical and specialized necessities on the specialized determinations of the technologies, further this progression has numerous choices which are still feasible. In this work, we portray an IoT system structure system with golden section optimized recurrent neural network (GSORNN) that additionally considers as an key economic choice for CMS. Thus, the decision set of attainable technologies for the experimental results shows vital decisions which can be measured from the point of view of a dairy farmer. Applying this measurement strategy on the portrayed CMS framework demonstrates a yearly decrease of 250 EUR per cow for dairy the management costs as suggested by Silent herdman survey.

Keywords: Cow monitoring, IoT, Neural Network, milk yield, Silent hearman.

1. Introduction

Most of the dairy farmers face many difficulties and pressure, in order to increase the operational efficiency of the farms, Further different technologies used mainly for the

purpose of increasing the production of milk from cattle. Most of the diary producers in United Kingdom have been fallen from the count 35741 by the year 2016 which has been gradually decreased to 13355 by the year 2017. Gradually the dairy cows have also been decreased from 4.2 million by the year 1980 to 2 million by the year 2017[1].But still milk production has been increasing sometimes, it is relatively in constant level.This is because due to the genetic gain and the huge part has been focused mainly by using different agricultural technique for the farmers in order to improve the fertility of the cattle and the animal health behavior has done to increase the milk production [4].The sales growth has also been increased which has been given the efficient power in reproduction.The commercial success has been stepped by introducing the various types of technologies and a great challenge is taken in order to deliver the animal health welfare related information's in an accurate way[2].

A special type of indicator which has been kept to monitor the shooting behavior of the cow or cattle and the digestion of the cow only then the nutrients will be observed in a perfect way[3]. Suppose if you find any of the cow taking less amount of intake and if you find any chewing spending time less for their behavior of ruminating which are due to some health issues. And this should be noted by using various Nano sensor s such as accelerometers lasers and microphones. some of the meters have been used to monitor directly which will give you the accurate pH value that will be very easy to indicate the rumen acidosis [23].The main purpose of using this SARA rumen acidosis is due to clearly determine the samples that are digested by using a tube in the stomach. The period is calculated based on the intake of the food, furthermore the digestion in the stomach is calculated and it is noted that the period should not exceed more than 3 hours. This reason helps to analyse the pH value that will produce lower than 5.6 for diagnosis .Some other studies have been proven that the pH value which falls below 5.5 with the single instance gives you a calculated value[5].However for the usage of rumenocentesis, the labor is not required often. However, still the availability of the person should be needed commercially in order to determine the pH value and also to compare the process by using several commercial systems [6].

Many of the authors in the recent past have proved that commercial system produces an excellent pH value with very lower power consumption for long-term process. Whereas the IoT Nano sensor lifetime has not been predicted regarding the power consumption.The overall activity of the cow has been monitored and mainly the indicators which are placed in the boluses of the cow that will be very helpful to determine the oestrus based activity[7,8]. The activity includes drinking, eating various effects in order to produce the exact pH value of the cow.If the value is determined very accurately it will be very efficient in production of milk. Suppose if there is any failure this will exactly result in the pregnancy time of the cow which will give you a loss in your revenue. So a perfect accelerometer should be kept to measure the complete activity of an animal which will help you to increase the one set of the behavior of oestrus.Suppose if the animal health is affected the amplitude rate , it will show some differences and here you can determine the cause and pain of the animal [10].If you find any indigestion problem, the clinical changes and signs will be noted by using hypo motility.A study has been explained where 40 number of buffaloes as well as cows has been suffered with indigestion problem and reticular ruminal hypo motility has been found with higher minimization[9]. The IoT Nano sensor used will be very helpful to reduce the

problems that have been raised for animal.Hence the measurement which is used for reticular ruminal should be monitored very clearly which will completely help you to improve the health of the animal protection and welfare performances[24]. This study will completely help you to increase the animal health by using accelerometer bolus based study.

This research is mainly based on the estimation time taken for rumination of the cattle that is mainly monitor with the help of GSORNN based monitoring machine ,which exactly gives you the contractions of reticular ruminal part of the cattle. The accelerometers which are used which will not give you the exact information of feeding bottle with rigorous manner,This paper will completely provide you the information about the possible tool which is used to measure the rumination as well as parturition and time of indication that are related to the feeding time of the cattle temperature and the welfare of the production. Here Section 2 discusses the literature survey whereas section-3 describes the IoT system structure system with golden section optimized recurrent neural network (GSORNN), Section-4 Analysis the experimental and numerical factor. Section-5 Concludes the research with future scope.

2. Literature survey

Survey says that most of the time cattle spend their whole time in chew over process [11]. The behaviors' are monitored specially for cows and this is one of the very effective ways to monitor the chew over patterns which is one of the different and interesting processes. The welfare of the animal health is monitored and the utilization of grass eating behavior is also monitored [12].Naturally human will face some difficulties while monitoring continuously the behavior of eating of Cow. The process of manual monitoring will be taken numerous for numbers of animals and this is one of the very time consuming process and it is also very labor intensive [13]. Only when you expand the whole commercial farming process you will see some profit in your business for that you have to increase many number of animals and this will automatically result in reducing the labor cost and time.The worst situation is raised during the time kept for roaming freely in outdoors and during the time of grass eating [14]. The risk factor that is raised during the time of observing by the observer should always be present to monitor the animals and sometimes the animal will behave in a different way when any human being is present near them, so you will not get any results very accurately [25].In order to avoid the situations a machine which is invented to record an automatic device appeaoch (ADA) will be very helpful to record the behavior of animal and it is a very useful machine to monitor the welfare of animal health,productivity and the efficiency of animal [16] [15].Since we are updated in modern technology we have many parameters to monitor the behavior of the animal and it is potentially helpful. The parameters which are used by the gyroscope and the accelerometers is very helpful to identify the behavior of animal.All the modern technology that monitors the cattle behavior includes mainly the behavior of eating which has been reported with the high accuracy of about 90 to 95 percentage. Here you can give various type of eating behavior of cattle clearly in this automatic monitoring machine [17,18].

There are some machines which are mainly used for commercial purpose that are named as Lely (LY) and another machine is named as Moo monitor (MM), these are very useful to

monitor the dairy cow of the feeding behavior of animals [19] [20].All the machines which was invented mainly for the monitoring of cattle behavior and there is no particular machine that is helpful to monitor for cow. The above monitoring systems will be very helpful in monitoring only for cattle it is very difficult to monitor Cow's because it produces algorithms in different manner, since the size and the weight of the animal differs and hardware is not supported for cow.When comparing the behavior of cattle there are still more monitoring systems and studies which will give you the data with high quality report and accuracy is also very high for about greater than 90 % [21].

From the above survey the main aim of this particular research as follows:

- By using various method of machine learning based multiple adaptive boosting algorithm the behavior of grazing under ruminating in cow should be classified.
- The exact feature should be completely extracted by using the data and classification process.
- Here various different multiple algorithm should be compared in terms of various classifications and indicators using golden section optimized recurrent theory from IoT Nano sensor data.
- The performance classification has to be investigated in detail. Here for all case studies gyroscope Nano sensor and the accelerometer have to be noted with the sampling rate of 16 Hertz.

3. Materials and Methods

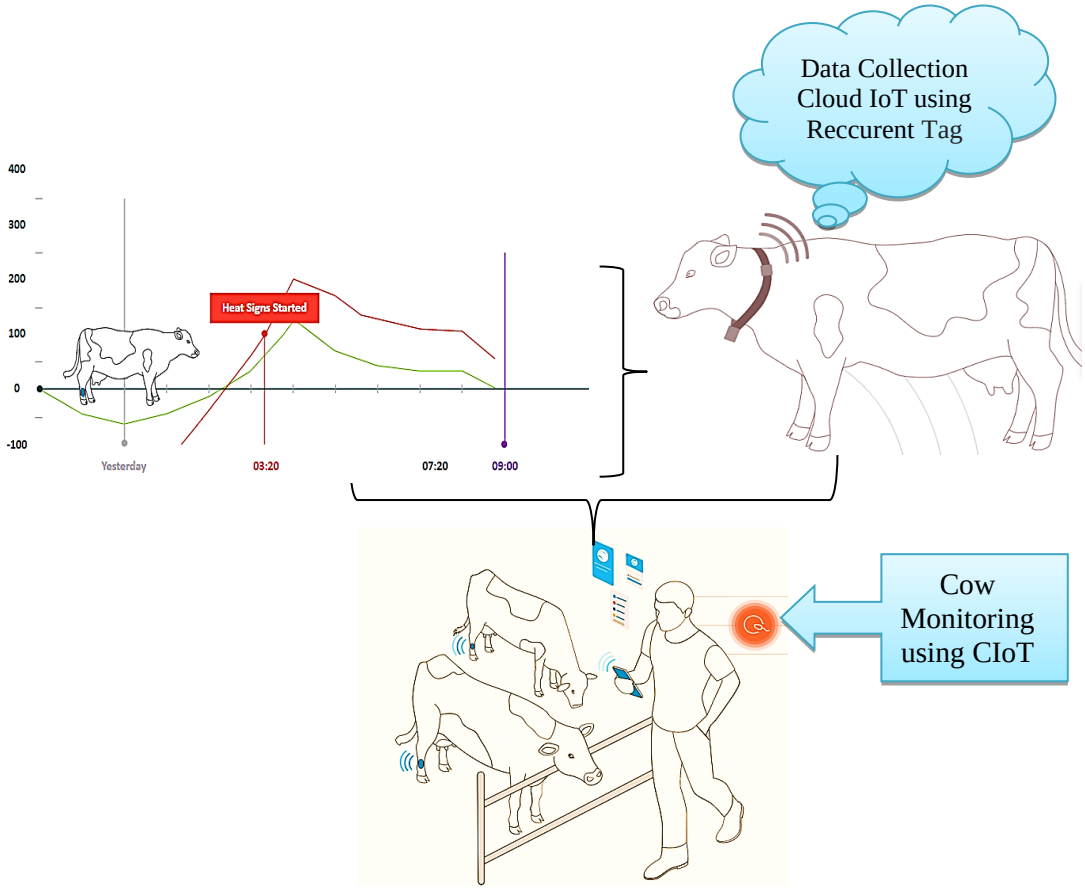

Figure.1. Cow Monitoring system with CIoT framework

A. Study site and animals

In the Site Here the characteristics of the animal breed, age and the complete data are collected. Initially a detailed study was collected in the university in order to collect the data of the behavior of cow. So totally 6 numbers of Cow's was randomly selected from 140 animals in the university and the complete study and their characteristics were noted as shown in the Figure.1. in Cloud Assisted Internet of Things (CIoT) environment. Each and every body condition has been noted in detail including their fatness degree of the animal, rumination and parturition [22].Normally the ages were included from 18 month cow to 4 years. The variety of breeds has been selected as 10 sets of jerry cross is taken for analysis.

B. Collection of information

The data were collected by using a IoT device that is built with microcontroller C 1000 and the device is excellently built with flash memory low power consumption and it is capable of monitoring wide area module with voice and it is featured with 16 bit gyroscope triaxial meter and with 16 bit accelerometer as shown in the Figure.2.. All these devices are

completely tuned and they are attached with their 6 Cow's in order to monitor their behavior it is tied in the collar of the neck by using a lightweight plastic tape which will be very easy to monitor the behavior of the cow excellently.

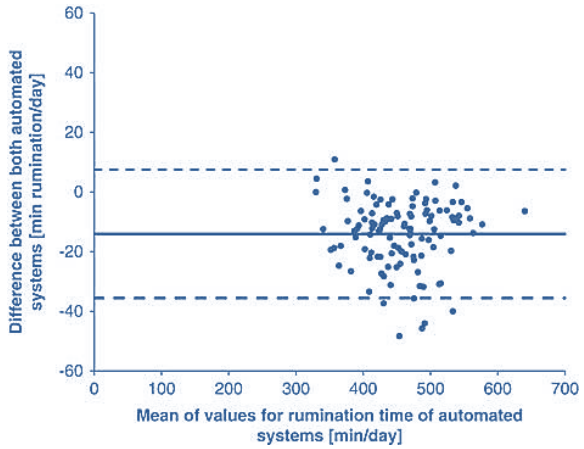

Figure.2. Rumination measurement using gyroscope triaxial meter and with 16 bit accelerometer

And ear mounted devices also fixed in front of the cow. These devices are mounted approximately by 9:00 a.m. and it is removed by 9:00 p.m. on each trial day. Sampling frequency was noted each and every day and the differences were recorded. Even the video mode was made to record in order to avoid the Nano sensor s which are raised due to the shaking position of the cow. This procedure was followed for about 30 seconds for reference horizontally and 30 seconds for vertically in order to avoid the disturbances during the time of shaking. Each and every period the recorded version will be downloaded if needed for the trials will also be taken.

C. Observations during behavioral Cow

Every behavioral activity of the Cow has been directly recorded by using the Panasonic handheld device and it is perfect video camera how to record all the behavioral activities of the cow clearly. This video camera which was built with 64 GB memory SanDisk and it will completely store all the footage of the cow behavior. The quality is also very excellent which is recorded with MP 450 M format and the quality pixels is designed with 1080p (1920*1080 pixels).Each and every day the entire video footage will be recorded and it will be clearly noted for every starting and ending session using CIoT environment .Videos were recorded with different kinds of categories with different behavioral activities which is performed by the cow even the playing video are recorded and these are process the manually with the set of functions. By recording all this behavioral activities the detailed study is noted based on ruminating behavior, non teaching and grazing behaviour.

D. Information processing

The detailed information was gathered by using a Nano sensor data gyroscope and accelerometer which played excellent role in monitoring all the behavior of the cow in various types. Here the overlapping sequence was also monitored in each and every file.

During the time of coding section each and every individual data of the cow will be recorded and assigned without any discrimination.All the information's are collectively noted and each and every particular activity is recorded and the samples are clearly listed out for the study. Here even non- mixed and the mixed samples are taken to determine the sampling rate of frequencies as shown in the Figure.3..For every characteristics feature the magnitude and the acceleration point is noted by the gyroscope and it is defined by the following as in the Eq(1) &(2)

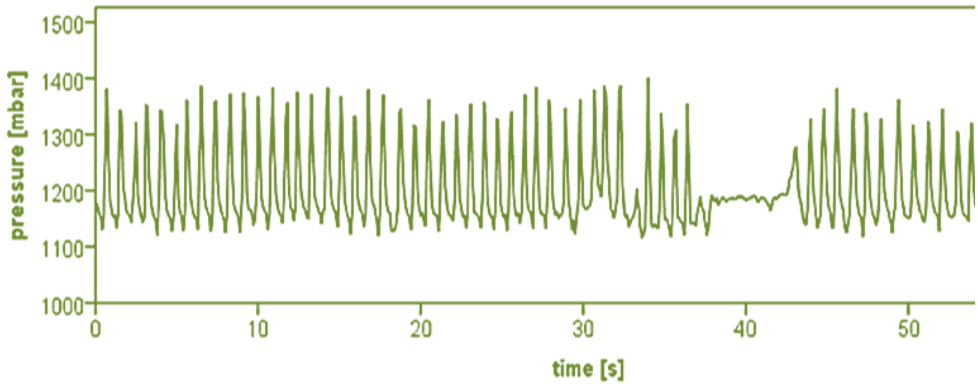

Figure.3. Rumination monitoring of sampling frequency range

$$\overline{X} = \sqrt{X_i^2 + X_j^2 + X_k^2} \quad (1)$$

$$\overline{Y} = \sqrt{Y_i^2 + Y_j^2 + Y_k^2} \quad (2)$$

Here X_i, X_j, X_k, Y_i, Y_j, Y_k It is the representation of gyroscope and acceleration signals. Totally different characteristics features of eleventh types are extracted with the help of acceleration and magnitude based on the old literature work with this recorded characteristic features are totally computed by the change of acceleration and magnitude rate of signal.The exact time required for the gyroscope and accelerometer signal is classified and it is noted for detailed study. The features are extracted which includes area of the signal standard deviation frequency dominant spectral entropy and minimum and maximum value.

E. Selection of the feature

The selection has been completely based on utility relief approach method.In this method all the relief original algorithm has been extended for the detailed study and also to estimate the quality of the data samples which are very close to each other. The main goal of the algorithm is to classify the problems based on two classes and it has been proved that the randomly noticed samples are very nearest to the neighbors of other classes. The parameter that is assumed the number of neighbors is 100 and also it helps to estimate the controls.According to python the eating behavior of the cow up has been classified based on the model and the features are described in detail in the above session. A type of enable learning method has been introduced in order to train the multiple trees in the random forests.And during the time when it has been applied to the information set all the individual

tree models are calculated in order to who classified the majority vote with the help of weight.A non probability input has been taken with the help of a support machine vector and this tries to provide very high dimensional space in between the two subspaces. The samples are clearly noted in the non-probability factor which will help to determine the unmonitored sample data and this feature which supports the vector machine model.Adaptive boosting algorithm methodology helps to provide the final decision based on majority vote method.The clear decision was taken by classifying the algorithm with the help of all training data sets which was combined with the neighbors and the nearest value has been noted.

F. Cow behavior recognition includes Rumination and parturition based on location

To determine the behavior of the cow then Recurrent neural network based algorithm technology which uses adaptive boosting model has been implemented which will be very helpful to determine the behavior of the cow. This technology which is used many number of times mainly for weak type of learners .A learner who's very simple faster and is very capable of implementing the classification in accurate way is a weak learner without any guess randomly.A technology adaptive boosting on recurrent theory helps to train all the weak learners and they completely boost to them to take the decision in an easy way. It can also be expressed as the adaptive algorithm which boosts up the weak learner to completely a strong classifier to perform their own operations in a strong level.

i) Classifier implementation

The behavior of the cow has been recorded from the starting session to the end session many number of times in order to match the data observation continuously. During the time of initial processing some of the information's are removed due to the purpose of accident delays.

Algorithm.1. Golden Section based Recurrent model usinge multiple adaptive boosting algorithm

- It describes about the multiple adaptive boosting algorithm and the input methods are taken as A={$(\boldsymbol{B_1C_1}), \ldots\ldots, (\boldsymbol{B_TC_T})$}, which are considered as golden factors here determines $\boldsymbol{b_i}$.($\boldsymbol{b_i}$€ A ≤ $\boldsymbol{M^3}$) it is the data three axis acceleration and here $\boldsymbol{c_i}$ is matching behavior class, the training set is B and this set includes 7 cow behaviors based on nuerla network concepts. T is the number of samples and the output is mentioned as adaptive boost method as J (p).
- The parameters that are included as $\boldsymbol{s_{1j}} = \frac{\mathbf{1}}{\boldsymbol{T}}$ j = 1…., T
- For p = 1 to P do
- Set of training samples are classified as $\boldsymbol{J_{1(a)}}$: A is {N=1, 2….7} N is the behavior of cow
- Rate of error is classified as $\boldsymbol{wrr_1} = \sum_{\boldsymbol{j=1}}^{\boldsymbol{T}} \boldsymbol{s_{1j}}$ * L ($\boldsymbol{J_{1(aj)}} \neq \boldsymbol{c_j}$) here the parameter l returns when it is satisfied or else zero.

- The co parameter should be computed as $\boldsymbol{J_1(A)}$: p1= $\frac{\mathbf{1}}{\mathbf{2}}$ $\boldsymbol{log}\frac{\boldsymbol{(1-wrr_1)}}{\boldsymbol{wrr}}$ + $\boldsymbol{log(N-1)}$
- The weights of the training samples are $\boldsymbol{s_{J+1,j}}$ = $\frac{\boldsymbol{s_{1j}}}{\sum_{j=1}^{T} \boldsymbol{s_{1j}\, exp\,(-p1biJ1(ai))}}$ exp (- $\boldsymbol{p_1 b_i J_{1(ai))}}$), (3)
- j =1, 2…T.
- for end
- Finally the output is J (A) = int ($\sum_{j=1}^{T} \boldsymbol{s_1 J_{1(a)}}$). (4)

Location information acquisition for Rumination and parturition

The location information it is collected in the form of data IDs location extra. These are explained in the form of grid and vertices manner. The boundary representations are expressed in terms of $\boldsymbol{X_i}$(i = 1, 2… (M-1), here M denotes the boundary parts. The distance is described as $\boldsymbol{y_j}$(1≤j≤6) and the vector distance is explained as Y (y1, y2….y6). And the vertices distances are W (w1, w2….w6).

The proximity factor is determined as in the Eq(5)

$$Z\ (Y, W) = \sum_{j=1}^{6} \frac{(1-\left(\frac{y_j - w_j}{y_j - w_{j+a_j}}\right))}{6} \quad (5)$$

Equation 1 is calculated with the array of elements F which is noted as in Eq(6)

$$F = [\boldsymbol{Z_{1,}Z_{2,\ldots,}Z_{(T-1)^2}}] \quad (6)$$

The equation are expressed in the form of vertices as shown in Eq(7)

$$(A, B) = (\frac{\sum_{i=1}^{3} \boldsymbol{A_i}}{3}, \frac{\sum_{i=1}^{3} \boldsymbol{B_i}}{3}), \quad (7)$$

The coordinates of leg and Collar reccurent tag are A, B and the vertices coordinates are$\boldsymbol{A_{i,}B_i}$. During the time when it is affected by environmental factors the measurement accuracy is also changed accordingly.

The changes are clearly determined in the model of propagation. The parameters are expressed in Eq(8) and (9)

$$\Delta = \frac{1}{6}\sum_{j=1}^{6} \frac{(m_j - n_j)}{n_j} \quad (8)$$

$$\boldsymbol{y'_j} = \boldsymbol{y_j}\ (1+\Delta) \quad (9)$$

Here Δ represents the coefficient of error and similarly it is represented in the distance form also. The $\boldsymbol{y'_j}$ and $\boldsymbol{y_j}$ represents the distance measured from the correct location and from the jth Nano sensor .

ii) Fusion method using Recurrent theory for complete monitoring of Cow

In this method the behavior of function of the cow is detailed classified based on Golden section recurrent neural network algorithm. The behavior such as standing feeding position

during parturition and then standing, feeding is explained in detail in the form of regular manner and uncertainty manner during Rumination. This theory will completely help you giving the accuracy of the behavioral method of the cow without any error. Here all the data are combined in multiple options and also adaptive boost algorithm on recurrent method is also used to provide the evidence correctly. Here g represents the mass function which indicates the behavior in a probability manner. Where g represents g: $2 \rightarrow [0, 1]$, g (∅) = 0 and $\sum_{b \pounds B} \boldsymbol{g}(\boldsymbol{b})$ = g (feeding) + g (standing) + g (uncertainty) = g (∅) = 1. as shown in the Eq(10,11,12,13 & 14)

g' = $\boldsymbol{g_1}+\boldsymbol{g_2}$ = (g'(feeding), g'(standing), g'(uncertainty)) (10)

$\boldsymbol{l_1} = \boldsymbol{g_1}(\boldsymbol{feeding})\ \boldsymbol{g_2}(\boldsymbol{feeding}), + \boldsymbol{g_1}(\boldsymbol{feeding})\ \boldsymbol{g_2}(\boldsymbol{uncertainty}) + \boldsymbol{g_2}(\boldsymbol{feeding})\boldsymbol{g_1}$(Uncertainty) (11)

$\boldsymbol{l_2} = \boldsymbol{g_1}(\boldsymbol{standing})\ \boldsymbol{g_2}(\boldsymbol{standing}), + \boldsymbol{g_1}(\boldsymbol{standing})\ \boldsymbol{g_2}(\boldsymbol{uncertainty}) + \boldsymbol{g_2}(\boldsymbol{standing})\boldsymbol{g_1}$(Uncertainty) (12)

$\boldsymbol{l_3} = \boldsymbol{g_1}(\boldsymbol{uncertainty})\ \boldsymbol{g_2}(\boldsymbol{uncertainty})$. (13)

L= $\boldsymbol{l_1} + \boldsymbol{l_2}+\boldsymbol{l_3}$ (14)

g'$(\boldsymbol{feeding}) = \frac{\boldsymbol{l1}}{\boldsymbol{L}}$

g'$(\boldsymbol{standing}) = \frac{\boldsymbol{l_2}}{\boldsymbol{L}}$

g' $(\boldsymbol{uncertainty}) = \frac{\boldsymbol{l_3}}{\boldsymbol{L}}$ (15)

From the Eq(15) Here the g' represents the behavior of combination of feeding and standing during Rumination as well as parturition. The above equations are represented during the time when it is present in the probability condition. Suppose if it is in the behavior of standing and feeding it is represented as

$$\text{Feeding}\begin{Bmatrix} \boldsymbol{g'(feeding)} > \in_3 + \boldsymbol{g'(standing)} \\ \boldsymbol{g'\ (uncertainty)} < \in_4 \\ \boldsymbol{g'(feeding)} > \boldsymbol{g'\ (uncertainty)} \end{Bmatrix} \quad (16)$$

$$\text{Standing}\begin{Bmatrix} \boldsymbol{g'(standing)} > \in_3 + \boldsymbol{g'(feeding)} \\ \boldsymbol{g'\ (uncertainty)} < \in_4 \\ \boldsymbol{g'(standing)} > \boldsymbol{g'\ (uncertainty)} \end{Bmatrix} \quad (17)$$

Here $\in_3$ and $\in_4$ are represented as the threshold points. Generally $\in_3$ is higher when compared to $\in_4$ for the purpose of reliability. Suppose when equation 16 and 17 are not satisfied it is determined as uncertainty factor and the information are accordingly removed from the processing and recognition factor.

iii) Optimized Recurrent Neural Network based on Golden factors

Among various Artificial neural networks, Golden section based Recurrent Neural Networks (are makes the networks to create cycles by summing weights to that network to form

internal state in the graph. The Network is generally used to sequence prediction problems. RNN mainly focuses on the sequence, time and result should be in the temporal dimension. Recurrent networks not only take the present input, it always concentrates both the current and the recent past to respond the new data. Recurrent neural networks are one of the feed forward neural systems increased by the consideration of edges, corners and boundaries that length continuous time data, presenting a consideration of time to demonstrate a model. Like feed forward systems, RNNs might not be a cyclic process among regular boundaries. In any case, boundaries associate to continuous time data, called intermittent boundaries, may shape cycles, including that having length which are connected itself from the node to itself across varying time. The best RNN models for sequence taking from the primary Long Short-Term Memory by presents the memory cell, which is a unit of calculation instead of customary nodes in the concealed layer of a system. With the help of these memory cells, systems can defeat challenges with preparing experienced by before intermittent systems. Bidirectional Recurrent Neural Networks presents a design in which data from both the future and the past are utilized to decide the yield anytime in the sequence This is as opposed to past systems, in which just past information can influence the yield, and has been utilized effectively for grouping naming in regular language preparing, among others for complete cow monitoring. Luckily, the two advancements are not totally unrelated, and have been effectively consolidated for phoneme order. A simple recurrent network shown below in the Figure.4

Output(O/P), Hidden layer(HL), Input(I/P)

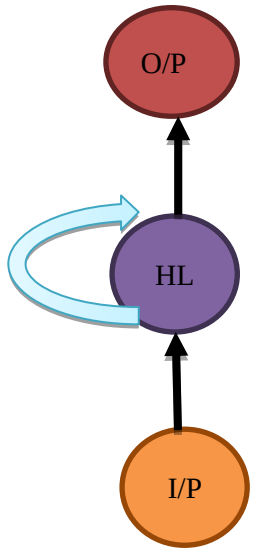

Figure.4: Simple Recurrent Network

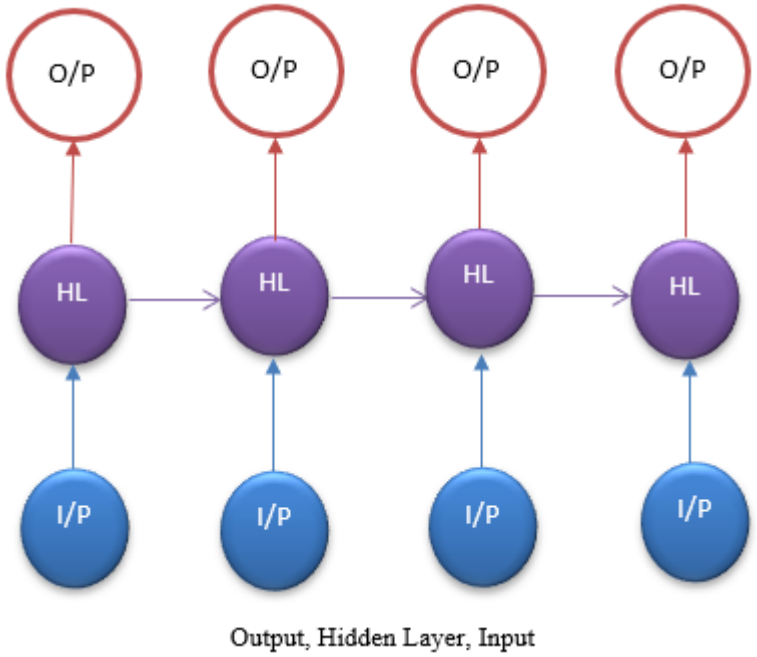

Figure 5: Vanishing Gradient Problem using Golden Section Recurrent Neural Network

The function of a length measure between an interval of time is fast .As like it the power of the input at initial time will reduced exponentially at a very fast rate at the final stage . It is possible only when the weight along the recurrent boundary is less than one . GSORNN model basically in request to reduce the issue of vanishing gradients as shown in the Figure.5. This model takes after a standard intermittent neural system with a concealed layer, yet every conventional node in the hidden layer is replaced by a memory cell for proper cow monitoring. Every memory cell contains a node with a self-associated repetitive edge of fixed weight one, guaranteeing that the gradient can be without disappearing or detonating. To recognize references to a memory cell and not a conventional node, the expression "long momentary memory" originates from the accompanying instinct. Feed forward intermittent neural systems have long haul memory as loads. The loads change gradually during preparing, encoding general learning about the information. They likewise have memory as transient which go from every node to progressive node. The GSORNN model presents a middle of the road kind of capacity by means of the memory cell.

The equation to calculates the internal state is as shown in the Eq(18 & 19)

$$\boldsymbol{S^{(t)} = g^{(t)} \odot i^{(t)} + f^{(t)} \odot S^{(t-1)}} \quad (18)$$

$$\boldsymbol{g^{(t)}, i^{(t)} \,\&\, f^{(t)} < 1} \quad (19)$$

Where $\boldsymbol{S^{(t)}}$ is input node

$\boldsymbol{g^{(t)}, i^{(t)} \,\&\, f^{(t)}}$ ***are gate nodes anf forget nodes respectively***

The following equations gives the full algorithm of GSORNN with forget nodes as shown in

the Following Eq(20,21,22,23,24 & 25)

$$\boldsymbol{g^{(t)} = \varphi(W^{gx}x(t) + W^{gh}h(t-1) + b_{g)}} \quad (20)$$

$$\boldsymbol{i^{(t)} = \sigma(W^{ix}x(t) + W^{ih}h(t-1) + b_{i})} \quad (21)$$

$$\boldsymbol{f^{(t)} = \sigma(W^{fx}x(t) + W^{fh}h(t-1) + b_{f})} \quad (22)$$

$$\boldsymbol{h^{(t)} = \sigma(W^{hx}x(t) + W^{hh}h(t-1) + b_{h})} \quad (23)$$

$$\boldsymbol{z^{(t)} = \sigma(W^{zx}x(t) + W^{zh}h(t-1) + b_{z})} \quad (24)$$

$$\boldsymbol{y^{(t)} = \sigma(W^{yx}x(t) + W^{yh}h(t-1) + b_{y})} \quad (25)$$

Where "i" is the internal state

"f" is the forget node

"h" is the hidden node

"z" and "y"are output nodes.

Algorithm.2.The following algorithm using Golden Section based RNN is used to get the output nodes

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At time t= 0

Initialize i, f, h

Choose randomly $i^{(t)}_{search}$

Compute $f^{(t)}$ from $i^{(t)}_{search}$, h, f(T)

While t< hidden< forget time, repeat

Compute $f^{(t+1)}$ from $i^{(t+1)}_{search}$, h, f(T)

$I = I + I_{search}$

$F = F + F_{search}$

Get Z and Y

break

The prediction error on the output vector can be used as a recurrent vector for next calculation as the recent past output. The algorithm corresponds to the study of RNN optimization and also RN memory to generate long range spatio- temporal sequence of output data. Thus, we introduced another calculation with reduced the through space by exploitation and to tackle a streamlining issue on new space by utilizing the brilliant area search technique. For this reason, the converter can investigate a little search space to fulfill single module state of enhancement issue for the calculation.Hence it is suggested that GSORNN is considered as one of the effective and efficient way of monitoring the

completed activites of cow in CIoT environment.

4. Experimental Results and Discussion

Recently the evidence of the behavior of the cattle has been reflected in detail that is for example the reason study has been proved that the behavior of feeding cows is perfectly resulted in the recent study the total frequency and the duration of the ruminating behavior of the cow is suggested but still it produces difference in behavior classification. In above methods as discussed in the literature such as SARA,ADA,LY,MM none of them has used Nano sensor term of accuracy in the eating behavior of cow. If these Nano sensor s are used various different positions can be evaluated clearly by using the sampling rate of sequence 25 to 35 Hz.It is sure that the sampling rate and the position of the cattle behavior will completely give you the perfect rate of algorithm and simultaneously the sampling rate will give you the power consumption high.

In previous explanation it has been prove that by using gyroscope meter and accelerometer the sampling rate has to be clearly classified during the time of walking and during the time of standing behavior in cow and this will be very helpful in determining the efficiency and accuracy of 16 Hertz. The variety of breeds has been selected as 10 sets of jerry cross is taken for analysis.

In this performance classification of the proposed method each and every evaluation has been noted that is recall, specificity, precision, accuracy and F-score in an effective manner, further sampling rate and the position of the cattle behaviour has been analysed with less power consumption approach as shown in the Figure.6.

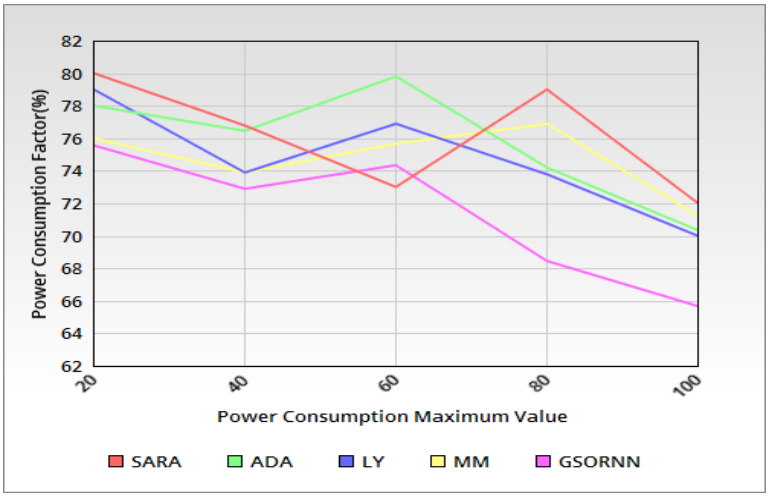

Figure.6. Power Consumption analysis

$$\text{Accuracy} = \frac{AB+AC}{AB+AC+WB+WC} \quad (26)$$

$$\text{Precision} = \frac{AB}{AB+WB} \quad (27)$$

$$\text{Recall} = \frac{AB}{AB+WC} \quad (28)$$

$$F - \text{Score} = 2.\frac{\text{Precision}.\text{Recall}}{\text{Precision}+\text{Recall}} \quad (29)$$

$$\text{Specificity} = \frac{AC}{AC+WB'} \quad (30)$$

The above equations (26,27,28,29 &30) describes as AB true positives and WC is denoted as false negatives these behaviors are clearly noted from the animal as ground truth. WB is false positives here it is falsely observed AC is true negative in which the instances are clearly classified but this is not observed.

Table.1. Error Rate analysis

Cow Sets Taken for Analysis	SARA	ADA	LY	MM	GSORNN
20	80.2	79.5	79.3	80	75.4
40	78.4	75.8	73.6	75.3	78.5
60	73.6	74.2	75.4	78.6	70.4
80	75.8	76.4	70.2	70.4	68.7
100	72.1	71.9	69.9	68.7	65.2

In this paper the cross evaluation has been performed for each and every model and the original information will be divided into testing and training sets to evaluate the correct sequence with less error rate as shown in the Table.1.For this purpose 10 fold cross evaluation was taken which was very reasonable to determine the performance and also help to estimate the resource computationally that helps to higher the iterations value helps to improve the precision ratio mean than SARA,ADA,LY,MM as shown in the Figure.7.

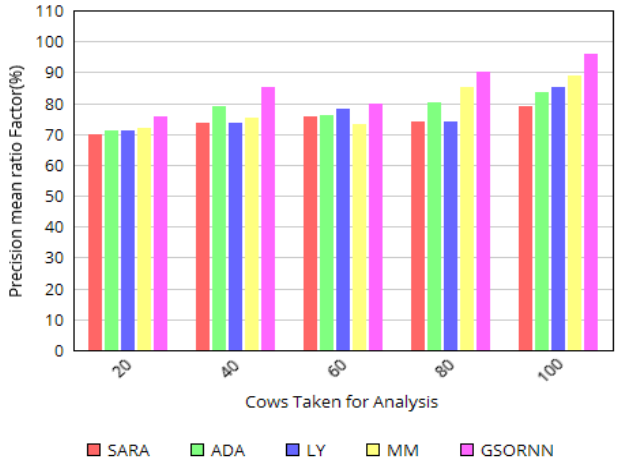

Figure.7. Precision mean ratio validation.

Thus, the decision set of attainable technologies for the experimental results shows vital decisions which can be measured from the point of view of a dairy farmer. Applying this measurement strategy on the portrayed CMS framework demonstrates a yearly decrease of 250 EUR per cow for dairy the management costs as suggested by Silent herdman survey.

5. Conclusion

In this work, we portray an IoT system structure system with golden section optimized recurrent neural network (GSORNN) that considers as an key economic choice for CMS. This research is mainly based on the estimation time taken for rumination of the cattle that is mainly monitor with the help of GSORNN based monitoring machine ,which exactly gives you the contractions of reticular ruminal part of the cattle as well as complete cow monitoring. Constant innovations in the field of IoT have opened numerous new open doors for observing animals and have been accelerating the improvement of CMS frameworks.Further this progression has numerous choices which are still feasible through accelerometers which are used which will not give you the exact information of feeding bottle with rigorous manner,This paper will completely provide you the information about the possible tool which is used to measure the rumination as well as parturition and time of indication using Recurrent Tag in CIoT platform that are related to the feeding time of the cattle temperature and the welfare of the production. In future machine learning based concepts are proposed to implement.

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