Animal Care Automated System

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ABSTRACT
In the field of animal care, farmers have made several breakthroughs, making sure animals are well fed at the right time and not being neglected. However, there is yet much problem in the homes and other areas where animals are being used. Radio Frequency Identifier (RFID) are being used mostly in farms to identify the animals in case of theft, and in order to recognize and differentiate the animals. However, that does not help in making sure they are fed at the right time and adequately taken care off when their owners are not available to do so. This study focuses on solving the problem of adequately caring for pets and animals either by feeding, checking their wellbeing, and other challenges associated with their welfare through mobile device system using intelligent RFID technology that can handle these responsibilities without human intervention. The study adopted an approach of assigning RFID tags to different animals, so as to observe behavior and other key wellbeing measures that offer a comprehensive depiction of animal welfare. Analysis of such data make available a range of insights cherished to the pet owner.

Keywords
Radio Frequency Identifier, Animal wellbeing, Passive and active tags, Validation of images, Animal care robotic system.

1. INTRODUCTION
Ever since the early 1970's, there have been considerable development in zoological welfare animal trends [1]. Farms, zoo, circus, parks and homes have become extremely specialized in their care for animals. For this reason, there have been staggering rise in the total sums of animals per facility unit and in capacity, hence this study is aim at designing an automated system to improve the wellbeing of animals using recent and advanced implicit science based tools. As animal welfare becomes more and more automated, with size often taking preference over quality and recognition being dedicated primarily on identification, protection and healthy status, efficient animal wellbeing will play a major role in all considerations about animal care and development. This is the reason why corrections to attitudinal, cultural, and commercial, communication and technological barriers between animal or pet owners and the people who eventually utilize them need to be addressed.

It is of important to state here that inhuman treatment and disease of animals have made it known to people that animal rearing or development is more than just an industry. Animal wellbeing project has identified three routes to improve animal welfare. These routes depend on knowledge-based, practical species-specific strategies that will be useful directly in the farm, or in different places of animal rearing as they support each other.

In the existing animal welfare system, animals are kept in sterile conditions. This may cause depression, worry, obsessive anxiety and harmful behaviors [2]. But in recent time, animal welfare has reformed to a more advanced method in which computerized mechanisms are a dominant tool for improving welfare difficulties. Adequate automated interaction, can also improve animal welfare [3]. Arguably, it is not far fetch to say that animal welfare automation process will by no means address both the physiological and ecological tactics on how to effectively care for animals. This informs the growing attention from the European Union research initiatives [4], and EU legislation that requires reliable and objective monitoring of animal wellbeing.

In reducing the need for human labor, electronic and mechanical equipment (often referred to as 'Automation') can be used, [5]. Application of automatic technologies such as computer automation systems, is a growing trend and plays a significant part in the future prospects in animal wellbeing since such systems recognize individual animal and pet owners to care for them more effectively and efficiently.

The values of decent animal welfare diverge greatly among different situations. These values are in continual assessment, argued, and reviewed by animal welfare groups, and academics around the world. Animal wellbeing science uses numerous actions, such as permanency, sickness, performance, physiology, and imitation; though there is debate about which of these pointers provide the finest information. Hence the need for the implementation of an automated system, that can effectively carry out these requirements. The most obvious characteristic of animal automation systems is the chance to tailor operations to the requirements of each separate animal. This is only conceivable if there are subsystems that will be able to recognize the creatures as they interrelate with the automated system. The animal welfare automation system can be used effectively to identify, feed and notify the owner for any form of intrusion capable of harming the animals. The wellbeing of animals is a human obligation that comprises consideration for all features of animal prosperity, including appropriate shelter, supervision, nourishment, avoidance of sickness and treatment, responsible care, and humane management.

Identification of animal is a method that identify and track animals. It is done for many reasons including confirmation of ownership, well-organized animal management, record keeping and security control. Identification of animals by their owners is of importance in other to draw attention regarding their status in performance as well as production [6]. Since animals are unable to express their own identity, the problem of their owners has always been to provide the symbols or codes that could be uniquely and indelibly recognized and identified. Hence the need for the development of an animal care automated system that can, care, protect, and monitor

animals effectively in real time when the owner is not available.

Several animal welfare techniques have been adopted by pet owners with the use of Radio-Frequency Identification (RFID) and Bluetooth automated devices; but animal owners are still being confronted with so many challenges in caring for their pets when not physically present to do so. The implementation of an automated resolutions such as the work presented here, makes it conceivable to access unfailing and comprehensive information about animal's state and intervene promptly and appropriately in real time. It is no gain saying that the automation of certain activities has been long recognized; but nevertheless, the use of methods guided by multifaceted logic such as this work, is a more current improvement, that makes use of electronic technology, and private systems for the management of animal's database.

2. PROBLEM STATEMENTS

Health and wellbeing are issues of major importance in both animal and human in which the inhumane treatment of animals by man cannot be overemphasis. The idea of animal welfare therefore originated on the evidence that humans have an ethical and moral responsibility to act compassionately toward animals and should act in a way to build the bond between humans and animals. Animal wellbeing is a human responsibility demanding active attention to all aspects of animal condition and well-being, including responsible agriculture, conveyance, care, humane accommodation, and handling. All these can be effectively carried out by animal owners. Animal health and (mental) wellbeing have suffered with increases in the size of farms, number of animals kept per farm and in absinthial of their owner. Deliberate efforts should be given to the animal's physical health, wellbeing as well as their emotions at all times. It is therefore imperative to critically examine and evaluate the existing animal care systems with the view to developing and implementing an automated animal care system using an intelligent RFID technology that will be able to handle these responsibilities without human intervention.

3. SIGNIFICANCE

Animal health and (psychological) wellbeing have suffered drastically in the absence of their owners; hence the need to develop an automated system to deter these. This way, the animals comfort can be evaluated round the clock. The automated animal care system proposed here, will comprise of an intelligent RFID technology that is able to measure behavior, pattern recognition, data fusion, image processing, and software architecture design. The significant of this work therefore is to develop an electronic device (system) that will look after these pets (animals) for the period of time in which their owners will not be available so that the level of negligence is minimize.

4. AIM AND OBJECTIVES

The aim of this work is to design an automated system using Radio-Frequency Technology that will help in caring for pets or animals effectively and efficiently in absent of their owners.

The objectives are to:

i. Improve animal welfare through an automated RFID technology by developing, integrating and disseminating information indicators about animal welfare.

ii. Trace the path of each animal from location to location through RFID and GPS technology in other to feed them in their owner's absent.

iii. Check and identify each animal exposed to external intrusion capable of harming their wellbeing through the use of positioned surveillance camera system and identification coding tag.

4.1 Animal Care and Welfare Automation Systems

In animal production, the most commonly used automated systems involve:

a) The technique of how the animals are fed, which can be employed using self- feeders that control the quantity of food and water saved in device memory, which will be decided by the owner and the software program deployed.

b) The monitoring of animals using physiological parameters and sensors positioned on the animals or installed in their cage.

c) The identification of individual animals for proper monitoring and inventory.

5. USING AUTOMATED IDENTIFICATION FOR ANIMALS

The greatest noticeable characteristic of animal welfare automation systems is the ability to tailor procedures to equal the necessities of each distinct animal. This can only happen if there are sub-systems that will allow the recognition of the creatures as they communicate with the system.

Automatic identifying systems are basically used in two key categories of applications [7], [8]. Looking at the primary application, the transponder is an essential part of an automated system. Its purpose is to recognize the animal from the control system. These type of systems normally make use of an immovable antenna, located inside the cage or along a forced route. The other application comprises the recording of the reproductive state of the animals and their health. In this instance, the automatic identification system has the purpose of obtaining, saving and showing the animal's identification code. This application uses transferrable antenna transponders that, once held close to the animal, allow its unfailing identification and thereby eliminates the struggle and danger of mistake associated with visual recognition of the code.

The system uses the following features:

i. A transmitter-receiver (antenna) that frequently broadcasts electromagnetic signals.

ii. A responder that will be by the animal, which will be activated by the electromagnetic signal broadcast from the antenna and transmits in reply a code.

The initial commercial automatic identification systems is dated back to the 1970s. In these form of systems, the responder that is worn by the pet was commonly attached to a collar. The technology of identification systems has however advanced, with decreasing in the quantity and size of components, less cost and optimal performance. Microelectronics components made it possible to substitute

many electrical components with Integrated Circuit (IC's). The resulting weakening in responder size has allowed a shift collar-worn devices to reduce chips incorporated into tags affixed to the animal's ear, as well as the latest injectable responders.

6. RELATED WORKS ON ANIMAL AUTOMATED FEEDING SYSTEM

A remote monitoring system that incorporates various sensors use for animals, which included a GPS unit was developed in [9]; while owner's mobile device using the Bluetooth telemetry that can communicate with the wireless system, known as 'smart' broad animal management system was invented in [10]. In this system, individual animals were given food with a wireless sensor and a remote, which can deliver precise dimensions of the location and other dynamic interrelated information of the animal wirelessly. [11], confirmed the performance of electronic identification tags and numerous readers on animals. Each animal is given an intelligent collar that consist of a PDA, a GPS, a radio unit and a sound amplifier. GPS was used to determine the position of the animal and was varied through a measurement of closeness of the animal to the fence boundary to drive the animals away from the fence on hearing an alarm.

To ease workload of feeding their pets and to save time and achieve flexibility, a lot of pet owners have been using an automatic feeding system which can only be installed on group of small animals [12]. This is why many pet owners have reported that their animals were a lot less stressed due to automatic feeding system. It is important to know that feeding low rank animals several times per day using automatic feeding system, enables the animals to feed better and take more food. Feeding without a fully automatic system accounts for approximately 25% of the total working time requirement [12]. Some of the current automatic feeding systems include rail-directed feed wagons, conveyer belts and self-driven feeders. These often encounter some challenges.

Based on the examination of the present available Automatic Feeding Systems, a classification can be built on the likelihood of feeding the animals either in groups or individually. Individual feeding offers the prospect to feed animals with different components that fit the precise necessities of each animal. The allowed device fills a provisional storage with the numerous feedstuffs, where a trolley automatically gathers and conveys little loads of the feedstuffs sideways an overhead rail to lesser hoppers. From there on the system makes precise rations on demand of the animals by putting the various ingredients in the individual feeding troughs in little-sized quantities; because it is important that the animal diets balance is taking into consideration for the average requirements of the total animal and not with individual balance rations. Hence an Automatic Total Mixed Ration Feeding (ATMRF) method is adopted.

6.1 Overview of Radio Frequency Identification (RFID) Technology

An RFID system has four elements when looking at its simplest form [13]. The RFID tag components comprises of an antenna incorporated with a microchip. The reader and antenna transfer an electromagnetic radio frequency signal. This signal is taken in by the RFID tag through the tag's antenna. The energy in the acquired signal delivers the power to the tag that gives permission to the microchip to operate. This is known as 'passive' tag. The data from the chip is then added to radio frequency signal that is 'reflected' by the tag which goes back to the reader through the reader antenna. This method is called 'passive backscatter'.

The reader encompasses the electronics to accept the signal from the tag, then acquire the RFID tag's code from the signal, which will then be returned to its digital form, and make available the returned code to a host computer. The tags are silent pending the time a signal is received from a reader. When multiple reader tries to 'light up' a passive tag, 'read collision' condition may occur because a passive tag can only be energized by one reader at a time. In a process known as 'Singulation' a Passive RFID systems can read multiple tags at once, the reader will quickly cycle through tags and choose which ones are present. There are many methods of Singulation, but the principle of identifying one tag is the same. When an animal passes the RFID reader, its information is obtained by the reader and sent to the host and displayed on the screen. With this feature, the particulars of an animal will be specified.

When trying to recognize many tags in the reader's field, it is very essential to communicate to a particular tag to avoid collision. The pretentious passive RFID tags have microchips that include a lone bit. These tags are known as 'Electronic Article Surveillance' (EAS) tags and are used to avert theft in shops. Other tags contain only serial number or numeric codes. The code, which is kept in memory on the microchip, could be inscribed to the tag at the period of first use or applied at the period the RFID tag is made.

The third major component in an RFID system are the Antennas. These can range significantly in reliant on functionality, cost, application and base operating frequency.

The host controller is generally a mobile device with android OS or laptop computer which is located nearby to the pet's owner. This controller aids two key purposes. First, it gets the required data from the readers and carries out data processing such as collation and filtering. Secondly, it aids as a device observer, to make sure the reader is operating accurately, securely and with up to date and precise commands. Host controllers are linked to readers through networking technology protocols such as (TCP/IP) or occasionally through serial connectivity. A single controller can manage numerous readers, with the ratio being reliant on the data volume from those readers.

The RFID systems are classified into low frequency (LF), high frequency (HF) and ultra-high frequency (UHF) according to the applied frequency bands. The most common systems for animal identification use the low-frequency (LF) band between (125 - 134 kHz).

7. DESIGN METHODOLOGY OF AN AUTOMATED ANIMAL WELFARE SYSTEM

The design methodology adopted for this work is based on practical experimentation, implementation and analytical frameworks coupled with personal experiences, motivation, structured thinking derived and justified by literature review, and computer software design strategies. All these form the model of the research process which is shaped by the

participants and underpinned by a philosophical paradigm [14]. The automated animal welfare system architecture consists of, a smart cage, RFID tags for identification, automated feeding system, and a security monitoring system inform of an alarm. The entry and exit of the animals known as gate is created because the going in and coming out of the animal population from the cage will be controlled by the gate. A computer software development of RFID Software Architecture for communication, interfacing and validation will be deployed to automate this system.

7.1 Design and Implementation of an Automated Animal Identification System Using RFID Technology

The RFID tags used consists of a 25-bit (5x5) code matrix of black and white pixels that is unique to each tag surrounded by:

1) A white pixel border and
2) A black pixel border.

In the 25-bit matrix there is a 15-bit identity code, and a 10-bit error check. The binary representation of a number between 1 and 32767, left-padded with zeros and reoriented into a 5x3 pixel matrix is the 15-bit identity. A unique 10-bit error check is generated for the code. The first 3-bits of this error code are parity checks, 1 (white for odd) and 0 (black for even) of each of the three columns of the 5x3 code matrix. By checking the parity of the first 3 and last 2 columns of the 5x3 code matrix respectively, the next two bits are generated. This 5-bit error check is repeated and reversed to give a complete 10-bit error check. This simple binary image matrix can be scaled to any size where it can be seen by a camera. Each one of the RFID tags is uniquely identified in a still image without earlier knowledge of its position using this technique. The frame or still image is first converted to grayscale before further processing, if it is in color. After it has been converted to a grayscale image, the next step is to threshold into a black and white image resulting in a binary (i.e. black and white) image, where zeros represent black and ones represent white. All unique regions are found by the software after it has been converted into a binary image.

The "imresize" function in Matlab to a range of image resolutions was used to artificially modify the resolution. The average area (in pixels) of the 12 tags in the image was then calculated and the square root of this value was taken to estimate the functional resolution of each tag, expressed as the mean length of each tag side (measured as the distance between 2 adjacent corners of the white rectangle containing the tag). The portion of tags correctly tracked across 255 frames from this sample video dropped dramatically below a resolution of around 25 pixels per tag edge. In order to guarantee an accurate localization and identification of the animals or pets that are kept in the cage, each one of the antennas satisfy precise requirements satisfied through the design of optimized segmented loops. A magnetic field is irradiated as confined as possible in the related cell. This guarantees a uniform magnetic field within the cell in order to minimize the level of the localization; which minimizes the far field radiation in an attempt to avoid potential spurious readings of the tags that can be found in the different cells.

7.2 RFID Card Reader Module

A widely used LF RFID readers (EM-18) of 125 KHz tags was used in this work because of its attractive characteristics. It provides both UART and Wiegand output formats. It is interfaced directly with the microcontrollers using UART interfaced with PC using an RS232 converter as can be seen in Figures 1 & 2.

Fig 1: EM-18 RFID module(forum.researchdesignlab.com)

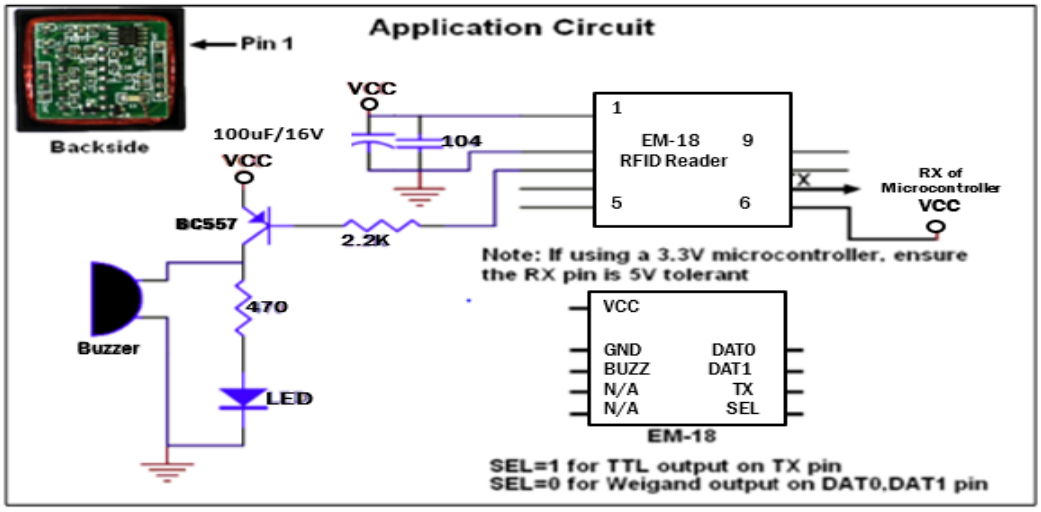

Fig 2: EM-18 RFID Circuit Diagram (entasla.com)

It releases 125 KHz from its coils and gets energized with the introduction of a 125 KHz passive RFID tag into its field. These passive RFID tags frequently comprise of CMOS IC EM4102 which gets adequate power for its working from the field produced by the reader. The information contained in the factory programmed memory array when the modulation current through the coils are changed, will be sent back by the tag as depicted in Figure 3.

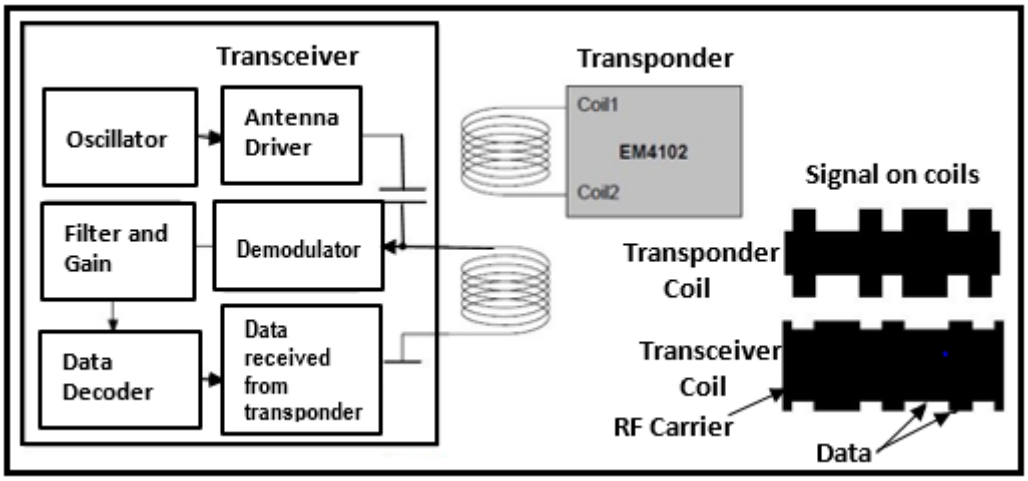

Fig 3: RFID System Principle Block Diagram of EM-18 RFID Reader, Vivek Kartha (2017)

7.3 RFID tag implantation procedure

The RFID tag helps to check the functional requirements such as great tolerance to mechanical stress, high reading performance in existence of liquids. The proposed identification system consists of a 4-port IMPINJ Speedway Revolution R420 reader connected to an IMPINJ GPIO adapter via one HD15 cable. The GPIO adapter permits for the connection up to four IMPINJ Antenna Hub, acting as multiplexers, each of which accepts up to eight reader antennas. Each Antenna Hub is connected to the GPIO-adapter via a straight Ethernet cable and to the reader with a SMA-male to R-TNC-female coaxial cable. A SMA-male to SMA-male coaxial cable is used to foster the connection of each reader antenna to its hub. The RFID reader contains four ports that help to power the reader antennas in time division. More specifically, only a single antenna is powered at a generic time, this tends to reduce the effects of potential array and energy wasting. When it is faced with this kind of a situation, the multiplexing system permits a switching time between reader antennas inferior to 200µs and a switching time between two Antenna Hubs mounted to 25ms.

Fig 4: RFID Active Tags

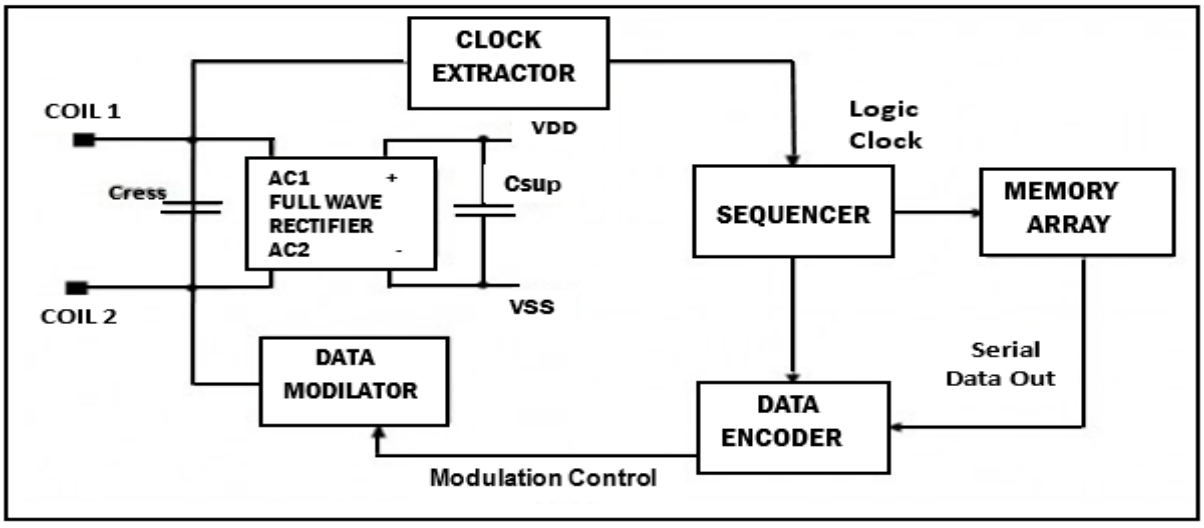

Fig 5: Block diagram of an RFID Tag [15]

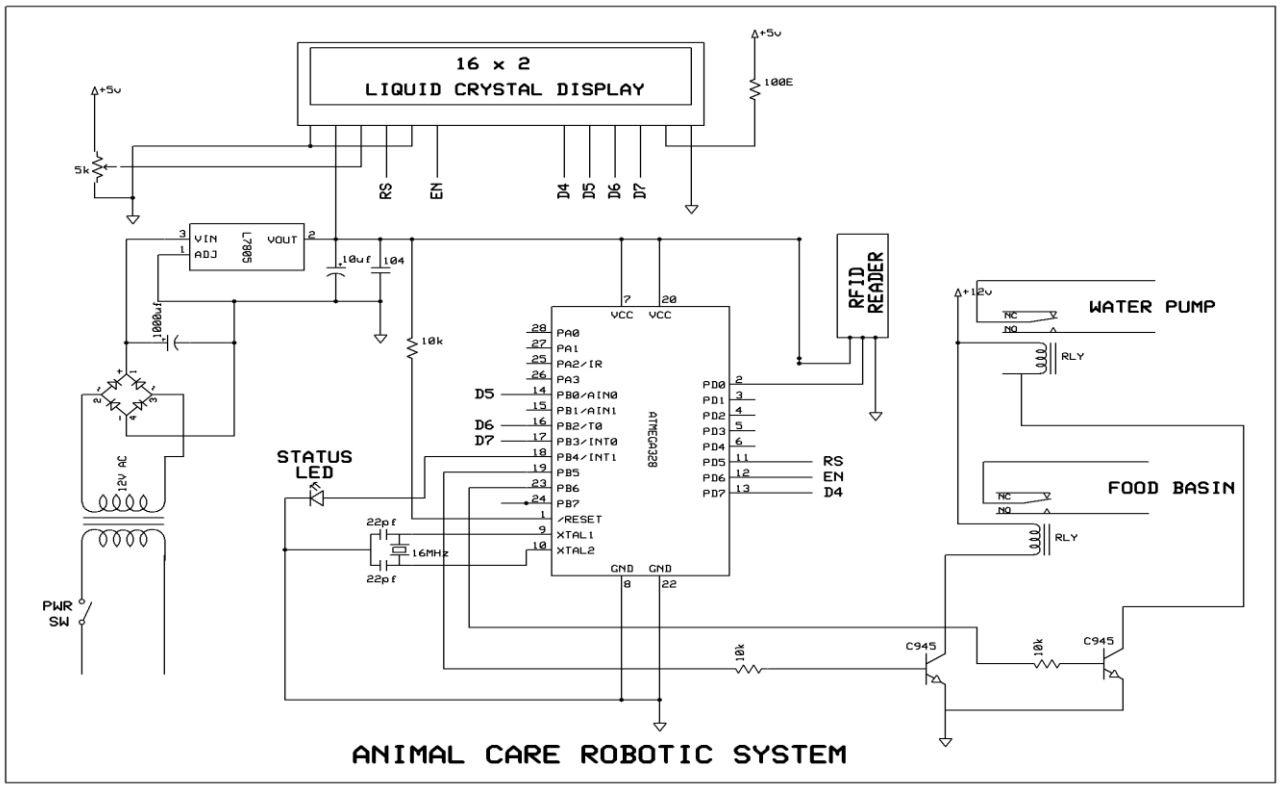

Fig 6: Circuit Diagram of Animal Care Automated System.

7.4 Design and Implementation of an Automated Animal Feeding System

Pet and animal owners allowed to conveniently tend to their pets and animals without human interaction through the design of an automated pet or animal feeder, thus easing their busy schedules. The pet feeder includes a mechanical feature, such as a servomotor controlling the feeding bowl, which is a linear actuator or rotary actuator that permits for exact control of angular or linear position, acceleration and velocity. It comprises of appropriate motor coupled to a sensor for position feedback known as Tower Pro SG90 servomotor, weighing 0.32 oz (9.0 g) and provides 4.8V at the speed of 0.12 sec/60 as shown in Figure 7.

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Fig 7: Tower Pro SG90 Servo Motor

The feeder makes use of a timer that limits the number of feedings per day to prevent overeating of the animals. The function overview of the automated animal or pet feeder includes:

1. Dispenses an amount of food that would be specified by the owner
2. Holds a reservoir of food
3. Prevents against any form of over eating that may pose serious danger to the health of the animals
4. Works together with the RFID tag based collar transmitter to identify the different animals
5. Helps to automate the feeding processes of the animals and
6. Activates a particular number of time a day

In order to reduce interference from similar transmitters, the RFID tag uses a multi-bit digital code, by adding a microcontroller that controls the dispensing mechanism. The transmitter on the RFID animal collar sends inputs to the microcontroller. The microcontroller outputs a set of instructions to the feeder's motorized mechanism, which dispenses food, and the feeder dispenses food automatically when the pet or animal is nearby. The pet or animal wears a transmitter that broadcasts its identification code approximately every minute, this code is transmitted to the receiver on the feeder and relayed to the microcontroller, the feeding process is commenced when the microcontroller reads a signal from the timer, the user or the pet owner will only get involved, by interfacing with the timer, through a mobile device, by setting up a specific feeding schedule that limits the number of time the pet or animal feeds.

7.5 Design and Implementation of an Automated Intrusion System

Intrusion detection system sensing and vision capability system helps to get a closer view and alerts the pet or animal owner, of any impending unwarranted intrusion. This is

achieved using the RFID technology and GSM. Due to the implementation of the automated system, the user can get clear footages of the animals without even going close to them. This design involves an observation technology with night vision capability system that make use of RFID remote to operate the observation process through which the vision camera is mounted.

This process allows the user to control and be updated wirelessly and get desired position of the pet or animal. The footage is recorded and watched on the user's mobile device or PC for reference. This can safely enable pet and animal owners to detect an intrusion, from an external area, that wants to get close and possibly harm the pets or animals by operating this device from a distance. This system consists of an 8051 family microcontroller unit used for processing through the RFID transmitter. The signals are received by the RFID receiver. The microcontroller processes the data and passes on signals to driver motors. The driver motors in turn operate the motors by providing desired signal outputs. Also when the microcontroller receives or senses a change, or an unusual directional movement, the camera directional change signal, and forwards this signal to the camera motor.

8. RFID SOFTWARE ARCHITECTURE DEVELOPMENT AND VALIDATION

There are four major components that the RFID software consists of and they are listed in the following order:

1. RFID Event Manager
2. RFID Information Server
3. RFID Management Console
4. RFID Configuration Manager

The RFID event manager converses with RFID sensor devices to bring about information from the animal's smart cage. This evidence can be kept in the RFID information server for current activities or future study. The RFID event manager is a disseminated platform involving one control station and single or multiple execution agents. The execution agent and control station are fitted on the same pet owner PC or mobile device for processing information, interactive with the hardware devices, and posting the information to the pet owner. The control station constantly observes the status of the execution agents. To offer high processing accessibility, if an execution agent flops, the configuration object is provisioned to another execution agent.

The RFID configuration manager is a Graphical Unit Interface (GUI) application used to state the set of devices coupled to the RFID event manager. The RFID configuration manager statically explain the manner to execute the information within the RFID event manager and where to refer the information after dispensation.

The RFID Management console looks after and manage the prestige of the devices that are linked to the RFID event manager. The RFID management console permits pet owners to look after the prestige of the animal well-being and welfare statistics and alter the runtime parameters for each.

8.1 Processing RFID Event Manager Information

For intense information produced by the devices linked to the RFID event manager, four main mechanisms are involved:

a) **RFID Configuration Manager: -** to statically express a single or multiple connectors that post information to the automated application**.**

b) **Application Level Events (ALE): -** postulates the kind of actions the automated application consumes. When ALE is being used, the application produces XML messages that describe the events of concern. The automated application requires to be programmed to handle the XML messages that are acknowledged encompassing the required information. Any of the Java or non-Java application that obeys with the universal ALE specification can converse with the RFID event manager.

c) **JAVA API'S*:* -** the Java Reader Client APIs controls devices, are used to program RFID tags, the read and write user memory and tag identification on RFID tags by making use of the Java library bundled with the RFID software. The automated application converses straight with the RFID event manager by using Java Remote Method Invocation (Java RMI) without the necessity to alter amongst protocols and data representation.

d) **WEB Service for Device Access*:*** -The web applications provide a 3 Dimension video that can reproduce the pet or animal activities in the cage. The user can cope by using the enabled smart phone or PC to control, the entire process. In order to improve the 3-Dimension component, the Web-GL technology can be used because it can produce and cope with 3-dimensional graphics unswervingly, permitting the communication with the 3 Dimension environment.

8.2 Development and Validation of Image Monitoring Process (Software Process)

C language Data was used for the software programming which is received by GPS from the satellites. This application supports pet or animal owners in the automated animal welfare system, because it is able to bring out raw data, kept in a relational database, in a way to deliver to the end-users (pet and animal owners) with an effective breakdown that recapitulates main animal welfare parameters. The application primarily processes the raw data with the help of the three stages of the RCP (RSSI Chebyshev Ping-pong). When an RFID tag is read by one of the reader's antennas, the well-being status of the animal is uniquely individualized. The user or pet owner included in the software programming in order to obtain notification on any form of intrusion on the animals and generates an array of images.

The steps involved in image generation processes are:

i. First Step: Image was read from the image database.

ii. Second Step: In order to increase the quality of the image, it was Pre-processed. Preprocessing encompasses identification and labeling of the objects that is contained in the images with the help of an image query processing algorithm. The main output of the pre-processing step will be a set of records, one for each image, encompassing the object identifiers for the objects involves in the image.

iii. Third Step: The Transformation of images was performed into database similar to a table. Each row in the table represents a pixel. Thus the number of rows (cardinality) matches to the entire number of

pixels in an image. The columns correspond to the features related with a pixel. These features can encompass means, contrast, local variation, etc.

iv. Fourth Step: Once the database table was attained, completed feature extraction follows. Features characteristics of the objects of interest, if carefully selected, are demonstrative of the supreme relevant information that the image has to offer for a comprehensive characterization of the lesion.

v. Fifth Step: Once features have been removed, achieve mining using suitable data mining methods to recognize appropriate patterns.

vi. Sixth Step: The resulting patterns were assessed and construed to attain the ultimate knowledge, which was applied to applications. The algorithm used is Content Based Image Retrieval (CBIR). The main objective of this algorithm is to put together the difference between the two images characterized in the form of two matrixes to produce the resultant matrix. Between the two input images, one image is the grey scale of the original image and the second one is the image gotten from the computation of the standard deviation of the input image. Segmentation and abstraction were then performed on the resultant image by the procedure of thresholding. It is a two-step procedure where image features are removed in step one to a distinguishable extent. When the intrusion is detected the calculated result is given to the alert system (pet owner mobile phone or PC) via serial communication port.

8.2.1 Algorithm

Step 1: Start
Step 2: Image acquiring of monitoring area.
Step 3: Apply the image mining algorithm to identify change in settled reference background
Step 4: If there is no change in the newly acquired image and settled reference go to step 5
Step 5: Apply the CBIR algorithm to identify the intrusion.
Step 6: Activate the alert system.
Step 7: Stop

9. CONCLUSION

This study examined the use of RFID technology in the modern approach to the animal welfare system, it has been observed that the RFID technology has the capacity to automatically, remotely and unremarkably perceive animal performance patterns in a zoo, circus, themes, parks, or homes and ensures that all the welfare parameters for determining their well-being is adequately observed, and transmitted, to their owner. The design and implementation of the RFID technology in the animal welfare system has confirmed to be a prosperous means for proficiently gathering high-standard, quality, and frequent data automated remotely, throughout the whole day. The Use of the active RFID tags has allowed pet owners a lease of control and flexibility, for knowing animal behavioral, physiological, biological, and social states. The study adopted an approach of assigning RFID tags to different animals, so as to observe behavior and other key wellbeing measures to offer a comprehensive depiction of animal welfare. Analysis of such data will make available a range of insights cherished to the pet owner. This work signifies the primary stage of a multi-layered project that will add abilities and functionality to advance animal care as further work on the software development and implementation is being awaited.

Future focus will also be extended to integration of artificial intelligence (in form of robotics) into the process of feeding the animals.

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