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Power Theft Detection in Agriculture and Field Protection- A Literature Survey

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Abstract: Power theft is a big challenge to be addressed in many countries. This has an negative impact on national economy. Agriculture provides food requirements to people and also provides raw materials for industries. Because of animal interruption in agricultural lands, there is a huge crop loss and crops are totally being destroyed. To avoid these significant losses, it is very important to secure agricultural farm from animals. This paper presents a literature review of various proposed technologies implemented in the previous years and their benefits and drawbacks. We have developed a system which can detect electric power theft and informs to the nearest power station automatically. Field monitoring is also a part of our proposed work which includes the following features: Elephant chase away technology, Bird shoo away technology, rodents siren technology. These technologies helps us in preventing crop destruction from animals.

Introduction

There was a time where when farming in India was dependent on cattle and all agriculture was labour based. Over time, technology has not only improved the level of farming in India but has also reduced the dependence on labour, hence replacing manual work with high performance machines, the most important advantage of modern times to us is Electricity. From sowing to irrigation and irrigation to Harvesting everything is being done with the help of power in the Agricultural sector. Power operated farming systems make the task quick, as well as enabling the judicious use of natural resources. Water pumps are the greatest breakthrough in improving the irrigation crisis in India as about $1/5^{th}$ of the total electricity is utilized in pumping ground water for Agriculture. Hence electricity has played a major role towards maintaining food security in India by increasing the rate of agricultural production. Thus proper power supply in rural areas becomes a necessity for successful farming. But the quality of electricity and illegal power supply due to power theft in rural areas are creating a major problem to the farmers. Further the unmetered supply has created an opportunity in hiding the T and D losses as supply to Agriculture. Regulators have also been unsuccessful in dealing with the problems of power supply to agriculture. Attempts at metering of pump sets and quantitative restrictions on over all supply have also not worked. Farmers have also ignored attractive metered tariffs. Further the power subsidy is effectively untargeted and poorer farmers have been denied its benefits. So power consumption and losses have to be closely monitored so that the generated power is utilized in a most efficient manner. An another major problem faced by the farmers is crop damage due to animals and birds. Farmers are inflicted with crop losses and other damages when animals and birds occasionally stray from their habitat and enter farm lands, destroying the field and plantations. Due to this there will be a large amount of economic loss for farmers. To avoid these financial losses it is very important to protect the agricultural field from animals. So the main objective of this study is to provide various measures for protecting the field without harming the living beings. In this paper the basic idea behind many technologies has been analysed and a system is proposed which is effectively able to detect the illegal issues of power faced by the farmers and also to prevent the crop damage caused by the animals in the field in an efficient manner.

Background

In this paper [1], Many species of rodents are pests in agriculture. Almost all field crops are affected by rodents. It was found that rodents cause damage at almost all stages of crop from sowing to harvesting. Moreover several traditional techniques are used by the farmers to control rodents. The two basic rodent control approaches are – the lethal approach, which uses rodenticides and trapping method which provides immediate solution to the problem. The non-lethal approach includes biological methods which may produce a more lasting effect. The traditional method such as placing of screw-pine leaves along the edges of paddy field and drooping of palm leaves in rice fields making a rattling sound were used by farmers to scare away the rodents. Biological control methods involves use of predators, parasites, pathogens and reproductive inhibitors against rodents. Mechanical techniques such as hunting, killing and trapping were also used to get rid of rodents. The chemical

methods include certain chemicals and their effectiveness depends upon the selection of an appropriate compound its formulation and the method and timing of application .

In this paper [2], Crop destruction by wild animals is a major problem in some parts of India. The objectives of the study were - To analyze and estimate the crop spoilage by wild animals on agricultural crops. To determine the efficiency of electric fences and other approaches to stop the wild animals from entering into the crop field. In order to prevent the crop loss by wild animals methods like fences ,trenches, and stone walls were used. Different fences like electric fence, bamboo fence, cactus fence, barbed wire cable were used. All these fences were effective in preventing wild animals from entering the field upto a certain extent. Trenches are the traditional methods which were build to keep away the wild elephants from entering the villages. Trenches completely prevented damage by elephants. Stone walls was constructed to stop elephants and other animals from entering agricultural crops.

In this paper[3], Birds are the bigger source to damage to crops. Particularly rice and fruit crops. This paper gives us knowledge about the amount of loss caused by birds and also how to minimize it. It is not simple to know how much spoilage is affected by birds. Here, the main pest birds are, two species of crow- jungle crow and carrion crow. The most important way of doing crop protection is to mask the farm by using net and other methodology is to decrease the bird population. Stimuli which disturb aversion in the birds are used to shoo them away from farms. In stimuli there are two major groups namely, Visual stimuli and acoustic stimuli. Visual stimuli consists of plastic bags and flags placed in the fields which will flutter in the wind. The acoustic stimuli brightens away the birds by sudden loud sound and this sound is made by using wooden clapper which is banged together by pulling it.

In this paper [4], Power theft is defined as political, regional, social, economical, infrastructural point of view. At present world technology which is in raising scope, they should also note the rapidly raising activities. Power theft is of major social problem so it is necessary to completely reduce it. Power consumption has to be closely supervised so that the generated power is utilized in a most efficient manner. In this proposed paper power theft is detected using wireless techniques. The illegal usage of power can be solved electronically without any human control using RF. When power is transmitted from transmitter to receiver load is applied. If there is any difference between transferred power and received power then we can say that stealing has been done through unauthorized person. The central observer reads the energy value and this energy value is compared with the sum of power consumption values. This process is mainly done to detect the amount of illegal theft. A new technology has been added i.e VEMS (Vigilant energy metering system) this collects data between other energy meters, local stations and base stations.

In this paper [5], Power theft has created adverse effects on all utility customers .It has been estimated that around 0.5 to 1% steel from the main supply. And there natural losses exceeds upto 1.2 billion annual loss in the electricity. Sophisticated power thieves either use elaborate tamper or bypass systems with internal meter mechanism. Tampering the current transformers (CT) of the energy meter, these are generally made non-conductive where the CF are not able to measure the current flowing in it. This kind of thefts can be easily detected using smart meters by glowing EL. This is an optional in the smart meter whose light emitting diode when flashed shows points i.e mismatch is detected between phase and neutral current.

In this paper [6], Grazing is also a part of agriculture where domestic livestock are used to convert grass and other foodstuff into meat, milk and other products. This paper concentrates mainly in protecting the biodiversity. According to today's demands, grazing system involved many new fencing techniques such as conventional fence, electric fence etc. But these fencing techniques were less flexible and more expensive .To overcome these limitations a concept called virtual fencing came into picture. The main methodology involved in this paper is that microcontrollers is used at the two of the ends i.e Transmitter and Receiver, which increases the accuracy of the system. Coding can be changes at the two of the ends depending on their needs. This system includes a wireless sensor network containing radio and sensors which are tied across the cattle's neckband and these sensors makes a sound when animals try to enter the cattle's boundary. The RF here is mainly used to transmit the signals. When an animal is within the range the transmitter will send the digital data continuously and receiver will receive it. If the data transmission is stopped, the receiver will not receive anything and a buzzer is activated and the LCD will alert the person at the receiver end for an immediate action

In this paper[7], Human-elephant incompatibility is a major issue which leads to crop damage, human death and injuries caused by elephants, and elephants being killed by humans. The inspection and tracking of elephants are difficult due to their size and nature of movement. A method for detecting and tracking elephants along the forest border areas using the sounds of elephants is presented. Two methods are used one is to find the spectral energy magnitude and the other to determine highest pitch frequency produced by elephants. Seismic sensors are used to detect the movement of elephants in forest border areas, whenever the elephant walk across the region of seismic sensors an alert is sent to forest officials and image cameras were used to capture the images and compare with a data base to detect the movement of elephants A threshold is identified for the two

methods When the elephant vocal transmission signal crosses the limit a message will be sent to the forest officials notifying them about the elephant interruption and also sends the elephant back to the forest.

In this paper [8], Nowadays power theft is the largest problem which accounts lot of loss to electricity boards. In countries like India, these conditions are more often, avoiding these thefts we can recover lot of power. This model is build in such a way that every consumer is accommodated with an automated meter reader with inbuilt microcontroller to detect the data consumed frequenty , PIC microcontroller is applied at consumer end and ARM microcontroller is applied on pole station. PIC convey data regularly and ARM process data , it previously has the details of amount of power sent to each line and it differentiates with received feedback , if the distinctness between these two values exceeds the prescribed limits then ARM microcontroller gets to know that power theft was happened and an alarm is raised , also sends message to authorities through GSM. Zigbee technology has effective transmission, self- healing network, low power utilization zero traffic etc. Zigbee transmission installation requires no special authorisation in most of the places.

In this paper[9], The power theft detection and monitoring is of greater importance In this proposed paper we are using, two parts they are – link method and remote terminal. The link method is used in the main energy meter in the substation transformer as well as consumer energy meter. The outcome of consumer's single phase energy meter also has an mutual relationship with power. If power theft has taken place then the consumer single phase energy meter cannot be measured correctly. There will be differences among the number of output impulse in standard power calculating module and in user single phase electric energy meter module. If the theft has occurred an alarm message is transmitted to the field man using GSM network. This is actually monitored by system software in control room.

In this paper [10], the main goal is to address the difficulty of crop damage by animals. It also illustrates the difficulties that are experienced by farmers through attack of animals on their agricultural field. The main aim of this paper is to give an efficient solution to these issues by using electronic surveillance system. This proposed system consists of following components such as camera, microcomputer, ultrasonic buzzer and passive infrared sensor. The camera and the additional components are connected with microcontroller. This device should operate for the whole day. The video signal is fed to the micro computer through the camera which helps in continuously monitoring the field. If any sort of motion is identified in the farm the microcontroller checks for the presence of animals. If the animal is detected the image buzzer is turned on and it also provides real time images of the farm which can be observed using web browser like mobile, computer etc.

In this paper [11], Power theft detection and monitoring is of greater importance. This is done through distribution lines, Power tapping on distribution lines is the main agenda of this paper. Microcontroller used here is STM85 which the information is taken from pole side and home side meter and performs the required control functions such as display reading, per unit amount and sends the appropriate data to the mobile phone through the GSM communication module .At the load side a 200w incandescent bulb is used as a load by which energy utilization by the user. On the pole side another meter record the power sent over each line connected to the pole. The power line communication is utilized for sending data over the power network .GSM is also used to transfer the information from the pole side meter and home side. The bulbs are connected to the load, which is used to calculate the average real power information.

In this paper [12], Electricity distribution jurisdictions lose a large mass of income, due to illegal connections or lack of honesty of consumers for their personal benefits. Different systems are suggested by scholars to determine the theft and reduce the non-operational losses .The techniques like SVM , Fuzzy C – means clustering , Fuzzy logic , User profiling etc are used to determine power theft .Latest research in power theft detection has progressively focused on building systems for electricity supplier organization consumer will use the product to recognise the potential faulty users with their specifics to reduce distribution losses.

In this paper [13] , The world economy of many countries is dependent on agriculture. Agriculture provides food requirements to people and also provides raw materials for industries. But because of animal interruption in agricultural lands there is a huge crop loss and crops are totally getting destroyed. To avoid these significant losses it is very important to secure agricultural farm from animals. Here, fencing wire is used as a sensor. An amplifier circuit is connected to the fence. If the animals are in contact with the fence the fencing circuit will be grounded and the proposed system will be activated. Using LDR, buzzer is operated. It also detects light intensity, if it is less, it will spot the light, due to this animals will not enter the field and it will run away. GSM module sends a message to the farmer after the system starts operating .

In this paper [14], We can discover power theft wirelessly. Unlawful use of electricity can be clear up electronically without any human control, using Radio Frequency (RF) technology. Electric power is transfigured from transmitter to receiver. If there is difference between transforming and receiving power, we can conclude that stealing of power has occurred from unauthorized person i.e , if energy is permitted from supplier to consumer at this time , if total amount of electric power is not collected by consumer then there is

feasibility of energy theft.

In this paper [15], Electricity theft is a very usual problem in country , where residents are very high and the usage of electricity are ultimately immense. In this paper , current transformers are used , one transformer is kept at the input side of post line . Other transformer is kept at distribution points of house lines. Output of CT values is fed as input to PIC microcontroller.PIC microcontroller transforms analog inputs to digital, differentiates the input current and output current. If result has negative values then it is recognized as power theft. This differentiated value is sent to electricity board, which is displayed in LCD display . The details will then be swiftly processed by microcontroller and a message will be sent through GSM.

In this paper, [16] Power theft is an illegal offence and it also effects the nation's economy. For reducing electricity theft, we proposed this system. This proposed system works autonomously without human involvement. Application of this system will not only elude issue of electricity theft but also will increase the number of customers and will increase nation's economy.

Proposed Methodology consists of 4 modules.

Module 1 : Preprocessing

For the process of identifying attributes , we are giving electricity distribution data in excel as input and get preprocessed data as output.

Module 2 : K means Clustering

For the process of data point and distance calculation , we input preprocessed data and get cluster as output.

Module 3 : Gaussian Distribution and ANN

For the process of Gaussian Distribution Probability and neuron formation , K means Clusters are given as input and we get Fine grained clusters as output.

In this paper [17], Food is the most important need for living beings. The protection of crop field has been a main content and a major issue. Animals are attacking the crop field over many years and the conservation of this crop field has become a main responsibility. The elephant detection is done by using image processing on raspberry pi board and it sends a message to the recognized person through GSM module. Camera is interfaced to the raspberry pi module. When the image is taken by the raspberry pi through the camera it is compared with data base image. After comparing the image if the output is positive/negative it gives commands to the GSM module .If output is positive Elephant is detected and message is sent to the recognized person using GSM.

In this paper [18], More crop damage is caused by wild animals which raid on the agricultural field. The farmers followed the traditional methods, but these methods were not so effective. The crop protection can be done by using computer vision techniques. This method is applicable for many fields, they are- medical field, robotics, remote fencing, machine vision, content based image retrieval. Cameras were installed for capturing images in the field. After capturing, these images are progressed in order to identify animal existence in the captured image. If the animal existence in the captured image is found then the identification is accomplished using W-COHOG and the output will be sent to the farmer using a communication module. In this paper weighted co-occurrence histograms of oriented gradient (W-COHOG) is used to determine the animal in the captured image which is highly accurate and also reduces false positive rates.

In this paper[19] , Wild animals frequently damages the standing crops. The annual result of crop losses are also covering economic losses to farmers. The low productivity is due to two major issues- Crop damaged by animals and crops damaged by nature substance. The main aim of this paper is to conserve the crop field from animals. Therefore this paper gives analysis for technical solution using wireless sensor networks and internet of things (IOT) to prevent their product from animals. A WSN includes a different clusters connected by sink node. Each cluster has a different sensor and each sensor require four main units they are - sensing unit, processing unit, transceiver unit and a power unit. This paper develops an algorithm to find the existence of animals in the field. Here, Raspberry pi is the heart of the process and each node has different sensors which is useful for determining the wildlife activity .The required activity will be taken from the actuator. Once the animal position is detected tracking can be done using ultrasonic sensor and raspberry pi is used to capture the image of an animal by installing cameras in the field. These images are sent to the user through GSM .

In this paper [20], both technology and science will have its prodigy which has fascinated social life to a greater extent i.e. imagining a world without these revolution is hardly possible. Power theft which is a non-ignorable offence or unlawful act which has to be controlled. This paper mainly focuses on the automatic monitoring and identification of theft which works under embedded controllers. There are different modes of theft such as meter tampering, meter tilting, meter bypassing etc. these can be overcome by tamper proof seals

and labels, tamper resistant screw or locks. It has check meter and remote meter for detecting power theft. Comparing revenue meter readings. If there is any change in the readings it indicates that there may be power theft or malfunction of meter. The whole process can be divided into many sections such as transmitting, receiving, processing and counter sections.

Power Theft Detection in Agriculture and Field Protection Techniques

Technology	Paper Name				
Zigbee	Wireless Power Monitoring with Power Theft Detection and Intimation System using GSM and Zigbee Networks				
Fuzzy Logic	Survey: Electricity Theft Detection Technique				
ANN	Electrical Power Theft Detection				
Smart meter	Electricity and Power Theft Detection		Virtual Fencing for Animals Management Using RF Module		
Sensors	Surveillance and tracking of Elephants using Vocal Spectral Information		Smart Crop Protection System	IoT Based Wireless Sensor Networks for Prevention of Crops from Wild Animals	
Image Processing	Surveillance and Tracking of Elephants using Vocal Spectral Information	Prevention o Wild Animals Entering into the Agriculture Fields	IoT Based Wireless Sensor Networks for Prevention of Crops from Wild Animals	Wild Animals Recognition in Agricultural Farms using W-COHOG for Agro-Security	
RF	Wireless Power Theft Detection	Minimizing Electricity Theft using Smart Meters in AMI	Unmanned Power Theft Detection and Automatic Power Breaking by Wireless Control System	Virtual Fencing for Animals Management Using RF Module	
GSM	GSM based Electricity Theft Identification in Distribution System	Design and Implementation of Power Theft Detection in Automatic Meter reading using Power line Communication	Unmanned Power Theft Detection and Automatic Power Breaking by Wireless Control System	Wireless Power Monitoring with Power Theft Detection and Intimation System using GSM and Zigbee Networks	Prevention o Wild Animals Entering into the Agriculture Fields

Sl no.	Year	Paper name	Basic Concept	Advantages	Disadvantages
1.	1998	Rodent Control in India	The traditional method such as placing of screw-pine leaves along the edges of paddy field and drooping of palm leaves in rice fields making a rattling sound were used by farmers to scare away the rodents. Biological control methods,	Traditional methods are effective compared to other methods as it is not harmful to rodents.	Mechanical techniques involves high labour costs & are less practicable over large areas.

			Mechanical techniques etc are also used.		
2.	1999	Studies on Crop Damage Wild Animals in Kerala and Evaluation of Control Measures	To prevent the crop loss by wild animals,methods like fences, trenches, and stone walls were used.	Electric fences with energizers were efficient and safe in controlling wild animal interruption.	Construction of stone wall was expensive, Trenches were not effective in southern areas due to the heavy rainfall.
3.	1999	Damage to Crops by Birds	Stimuli which disturb aversion in the birds are used to shoo them away from farms.	Razoo, a bird scaring device is used which is more effective than the previously used devices.	Razoo device is operated only in small areas and its requirements are very large & also the device is very expensive.
4.	2012	Wireless Power Theft Detection	If there is any difference between transferred power and received power then we can say that stealing has been done through unauthorized person. The central observer reads the energy value and this energy value is compared with the sum of power consumption values.	Location of the power theft can be identified using new technology called VEMS. Remote billing can also be done.	The technology used in this paper has some limitations where it leads power theft by using illegal practices such as bypassing the meters, illegal tapping.
5.	2012	Minimizing Electricity Theft using Smart Meters in AMI	Thefts can be easily detected using smart meters by glowing EL. This is an optional in the smart meter whose light emitting diode when flashed shows points i.e. mismatch is detected between phase and neutral current.	Smart meters will provide quick, accurate measurements of power eliminating the need for estimated monthly bills and home visits from readers.	Data produced by smart meters could be quite invasive. These devices can be hacked.
6.	2013	Virtual Fencing for Animals Management Using RF Module	System includes a WSN containing radio and sensors which are tied across the cattle's neckband & these sensors makes a sound when animals try to enter the cattle's boundary.	As RF module is used which is more flexible, , also improves in situations where fence may be difficult to install or subject to flood damage.	Using RF module, electronic collar is very complex.

7.	2014	Surveillance and Tracking of Elephants using Vocal spectral Information	Seismic Sensors and image cameras are used to detect the movement of elephants.	Reduces the work effort of forest officers and also has the ability to discriminate the elephants from other animals.	Difficult to develop an algorithm for every sounds made by elephants like trumpets,chirps,roars,rumbles.
8.	2014	Wireless Power Monitoring with Power theft detection and Intimation System using GSM and Zigbee networks	PIC µc is applied at consumer end and ARM µc is applied on pole station.PIC µc conveys data regularly and ARMµc processesthe data , it previously has the details of amount of power sent to each line and it differentiates with received feedback , if the distinctness between these two values exceeds the prescribed limits, then the ARM µc gets to know that power theft was happened and an alarm is raised , and also sends message to authorities through GSM.	Zigbee technology has effective transmission, self healing network , low power utilization , zero traffic etc. and Zigbee transmission installation requires no special authorization.	There is a specified limit in order to keep trace of all general power losses other than theft.
10.	2015	Smart crop Protection System	Camera and additional components are connected with microcontroller. If any sort of motion is identified in the farm the microcontroller checks for the presence of animals. If the animal is detected the image buzzer is turned on.	It provides real time images of the farm which can be observed using web browser like mobile, computer etc. Accurately predicts the presence of animals.Highly flexible	High power consumption. Device should be turned on whole day
11.	2016	Wireless Electricity theft detection and Monitoring	STM8S microcontroller performs control functions such as display reading per unit amount & send appropriate data to mobile through GSM.	Microcontroller is fully integrated, small in size and flexible.	Once it is programmed, it cannot be reprogrammed.It has complex architecture & development time is more.
12.	2016	Design & Implementation of an intelligent Security System for Farm Protection from Wild Animals	Fencing wire is used as a sensor, an amplifier circuit is connected to the fence. If the animals are in contact with the fence the fencing circuit will be grounded and the proposed system will be activated.	Helpful and affordable to the farmers. This system is not harmful to the animals and human beings and also it safeguards the	Electric fence delays the emergency services, if the bushes and trees are grown near the electric fence there is a chance of fire being

				farm.	caught.
13.	2016	Survey: Electricity Theft Detection Technique	Various systems are introduced to detect theft & diminish non operational losses. Methods like SVM, Fuzzy C-means Clustering, Fuzzy logic, User profiling etc	The review of different techniques is done to introduce new technique which is foreseen to have higher accuracy to detect electricity theft.This helps to further reduce the non technical losses in distribution of electricity.	Disadvantages combined with using these techniques based on their methodology is accuracy and also the framework needed to employ them.(SVM).
16.	2017	Electrical Power Theft Detection	Proposed Methodology is divided into 4 modules which includes Preprocessing, K means clustering, Gaussian Distribution and ANN, Fuzzy Logic.Electricity distribution data is given as input & we get approximate theft detected data as output.	Less time consumption, More profitable for utility company working in electrical distribution network.	The system developed is complex as distribution network is considered.
17.	2017	Prevention of Wild Animals Entering into the Agriculture Fields	Elephant detection is done by using image processing on raspberry pi board. Image is captured by raspberry pi through camera & is compared with database image. If the output is positive, elephant is detected & a SMS is sent through GSM.	Identifies the elephants even in the presence of other wild animals, also detects elephants coming in group, Harmless.	GSM is costlier, complex due to raspberry pi functionalities.
18.	2017	Wild-Animal Recognition in Agriculture Farms using W-COHOG for Agro-Security	Cameras were installed for capturing images in the field. Captured images are progressed to identify animal existence. If there is animal existence in captured image, then identification is accomplished using W-COHOG& output will be sent to farmer.	This technique accomplishes better efficiency on two standard data	W-COHOG method requires more cameras to be installed in the fields to capture the images which leads to high cost.
19.	2017	IOT Based Wireless Sensor Network for prevention of crops from Wild Animals	Develops an algorithm to find the existence of animals in the field. Once the animal position is detected, tracking can be done using ultrasonic sensor &	IoT provides a smart farm land protection system which is designed to	Smart farming requires computer knowledge, skills in robotics which

			raspberry pi is used to capture the image of animal. These images are sent to user through GSM.	protect farmers from economical losses caused due to crop spoilage, less wastage, maximum efficiency.	are lacked by farmers.
20.	2017	Electricity and Power Theft Detection	It has check meter and remote meter for detecting power theft. Comparing commeter reading and revenue meter. If there is any change in the readings it indicates that either there may be theft or malfunction of meter.	The use of microcontroller in this technology will make it flexible or simple. This is most desirable compared to other controllers	It cannot be interfaced with high power devices directly & it only performs limited number of executions simultaneously.

Problems to be addressed

In the literature survey, several techniques were proposed for detecting the location of direct tapping on a feeder or tampered energy meter and identifying the illegal consumers where periodic inspection of illegal connections involves a lot of risk and strain for vigilant officials. Integration of smart meters helps utilities in detecting unauthorized consumption and electricity
theft in view of improving the distribution efficiency
and power quality. Design deployment and maintenance of smart meter system involves many issues and challenges. Deployment and maintenance of smart meter system involves several billion dollars of investment. Smart meters can be used to their fullest extent only when all the appliances and devices in the distribution and metering network are included in communication network.

Integration of these devices becomes complicated with increased number of customers. Deployment of communication networks in some localities might also be difficult due to telluric difficulties. Collection and transmission of energy consumption data is a continuous process that needs to be done automatically which is an expensive job. Smart meters also might create some privacy and security risks as the data and signals are being transmitted. It would also be an issue of determining which parameters to be transmitted and who is authorized to access this information. In field protection several techniques developed till now are being harmful to humans as well as animals. In this survey, techniques like electric fences and installation of cameras have been found to be a risky process where electric fences caused electric shock to animals which were very harmful to them. Cameras installed in the farm has to be operated for long period which leads to heavy cost.

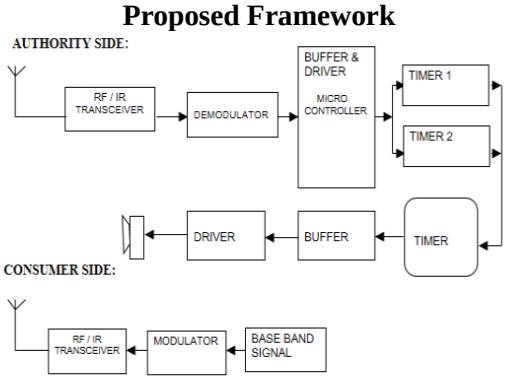

Fig 1 : Block Diagram for power theft detection

To the above stated problems, we propose a power theft detection technique using RF transceiver. The said system, is more useful in Remote areas.As shown in Fig 1 our proposed system mainly has 2 stages, i.e, Base station, Consumer and authority side.When power is transmitted from authority side to consumer, a pulse is transmitted from RF Transceiver1 to the main monitoring section.Timer1 is activated during this time via buffer and driver section. Now again a pulse is transmitted from the authority side, when this power is received at the consumer side another activation pulse is transmitted from RF transmitted 2 to the main monitoring section.When both the timers are activated with in a little span of time, it is predicted that power theft is not done, as the number of units transmitted from the authority side is equal to the number of units received in terms of acknowledgement from the consumer side.If the meter is by passed at consumer side then the transmitter 2 which is placed at the consumer side will be disabled and no acknowledgement is transmitted to the main monitoring section and timer 2 will be waiting for the input for some duration if that timer wont get any input the main timer will be activated and thereby it will trip the line hence no power will be transmitted on to it. At the same time, buzzer will be activated which indicates power theft is done.

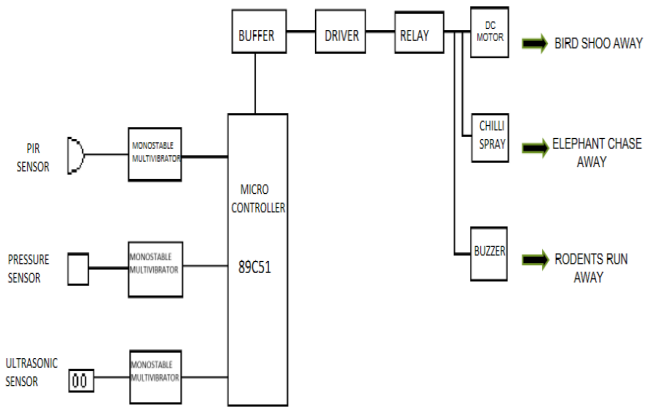

Fig 2 : Block diagram for Field Protection

We have also added advanced features such as Elephant Chase Away Technology, Bird Shoo Technology, Rodent Silent Siren as show in Fig 2.These techniques are unique compared to earlier techniques and are successful in preventing croploss. Elephant Chase Away Technology involves Pressure sensor which detects the entry of elephants, Capsaicin(chemical present in chillies) is sprayed on the elephants which irritates them and prevents from entering the field.Bird Shoo Away Technology includes PIR sensor which detects the entry of birds into the field.A disc is mounted over DC motor to drive the birds.As soon as the birds come near the sensor, disc will rotate and sun rays which falls on disc will cause reflection.This disturbs the eyes of birds and they will flew away from the fields. Rodent Silent Siren technology includes an Ultrasonic sensor. Ultrasonic sounds are neither audible nor disturbing the man. This sensor will detect the entry of rodents. As the rodents come near the sensor, the buzzer will make sound which irritates the rodents and causes it to move away from the field.

Conclusion

The study conducted in this paper presents a comprehensive review of different techniques used to detect the power theft and different sensors used to detect animals in order to prevent crop loss to farmers. Electric theft detection has been designed and implemented with the proper combination of both hardware and software. In this survey paper we see that there are many techniques used and also power theft using GSM has attracted much attention and has also been commercially used. The GSM technology lacks to detect the power theft in remote areas. In order to overcome this issue our proposed system uses a RF transceiver which helps detection of power even in remote areas. Advanced features such has elephant chase away, bird shoo and rodents silent siren technologies which are not harmful have also been included to protect farmers field from huge crop loss and help them in achieving crop yields thus improving their economic status. Therefore our proposed system is completely automated, wire free, cost-effective and highly reliable.

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