

Power Theft Detection in Agriculture and Field Protection

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Abstract- *Power Theft is a major challenge that is experienced in many countries. This has terrible effect on a country's economy. This paper introduces a system that detects power theft remotely and also a mechanism for suppressing power theft. The approach used here is that the electric current supplied from the distribution transformer is monitored at the distribution transformer side and at the consumer transformer as well. Based on the acknowledgement received and the difference in current monitored from the distribution end and consumer end helps us to know whether the power theft has occurred or not. Apart from power theft detection this work also protects crops from animals. 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 Field monitoring includes the following features: Elephant chase away technology, Bird shoo away technology, rodent's siren technology. These technologies help us in preventing crop destruction from animals.*

Keywords – *Power theft detection, Elephant chase away technology, Bird shoo away technology, Rodents siren technology.*

I. 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 1/5th 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 untariffed 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.

II. RELATED WORKS

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 involve 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 [1].

Crop destruction by wild animals is a major problem in some parts of India. The objectives of the study were - To analyse 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 up to a certain extent. Trenches are the traditional methods which were built 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 [2].

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 [3].

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 [4].

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 their natural losses exceed up to 1.2 billion annual losses 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 [5].

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 [6].

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 [7].

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 [8].

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 [9].

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 nonignorable 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 [10].

III. 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.

IV. PROPOSED WORK

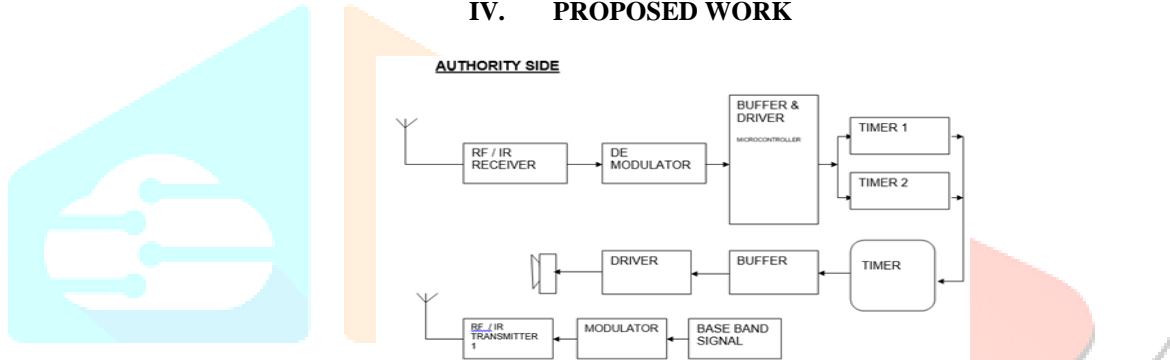


Fig 4.1 Block diagram of Authority side in Power theft detection module

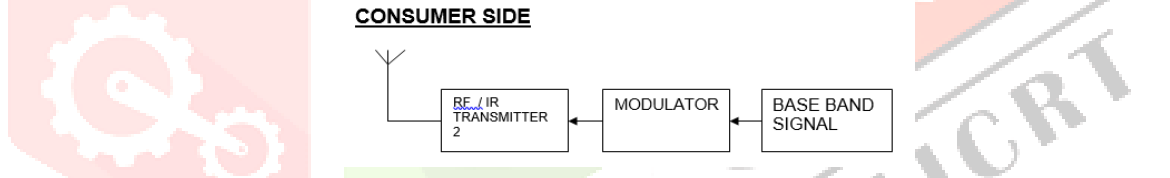


Fig 4.2: Block Diagram of Consumer side in power theft detection module

The block diagram consists of authority side and consumer side. RF receiver is placed in the Main base station. When consumer bypass the meter and connects any load to the supply then it starts consuming power. It means even power is being transmitted from authority side. When power is transmitted from authority side to the consumer at the same time, a pulse is transmitted from RF Tx1 to the main monitoring section, timer1 is activated during this time via buffer and driver section. Now the power is transmitted from the authority side. When this power is received at the consumer side another activation pulse is transmitted from the RF Transmitter 2 to the main monitoring section which acts like an acknowledgement where by timer 2 is activated. 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 signal or 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 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.

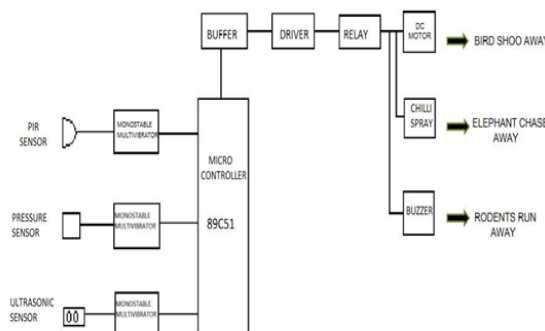


Fig 4.3: Block diagram for Field Protection

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 crop loss. 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.

V. SOFTWARE USED

KEIL COMPILER - Keil Compiler is software used where the machine language code is written and compiled. After compilation, the source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil Compiler also supports C language code.

VI. FLOWCHART

To program 89C51 microcontroller to detect power theft using the following flowchart.

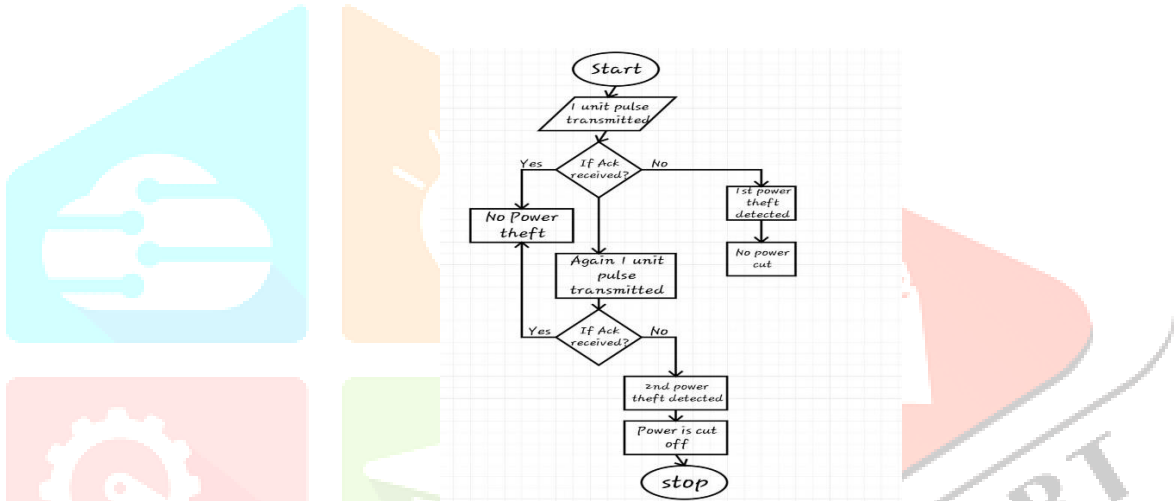


Fig: 6.1 Flow chart

VII. RESULTS AND DISCUSSION

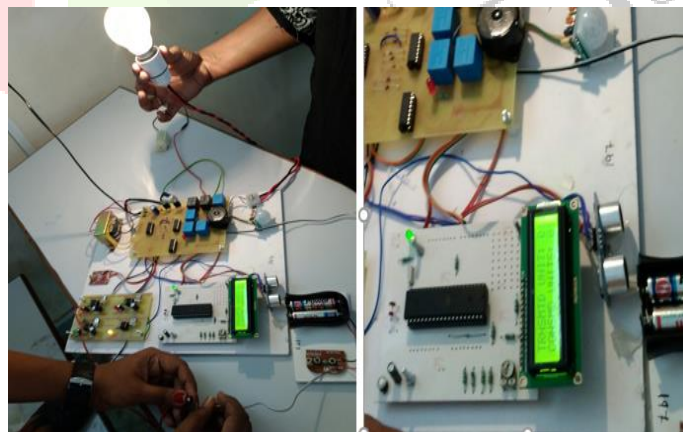


Fig-7.1: Transmitted power from the Authority side is consumed by the customer. This consumed power is showed in the form of an acknowledgement where in the above figure we can observe that the number of units (here the power is transmitted in the form of pulse) transmitted and the number of units consumed are equal and this information is displayed on 16 × 2 LCD display.

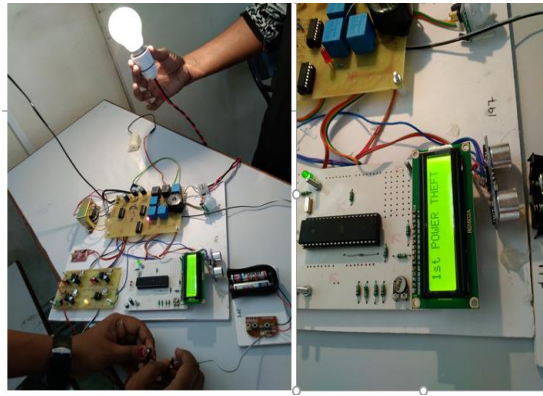


Fig-7.2: When the number of units transmitted are not equal to the number of units consumed, acknowledgement will not be received by the transmitter from the consumer side, during this time there will be the First power theft indication will be displayed on the 16X2 LCD with the help of Buzzer. The first power theft detection may also be displayed due to some technical issues. Therefore, we cannot say that power theft has exactly occurred. So during first power theft detection there will be no power cut.

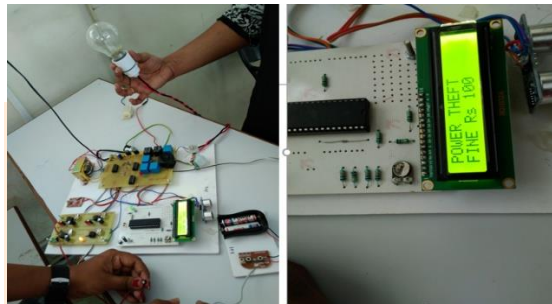


Fig-7.3: When the number of units in the form of the pulse are transmitted The consumption is not happening again. This time the number of units transmitted will be greater than the number of units consumed and acknowledgement is also not being received by the authority side. Therefore, due to the loss of more units of power we can say that Power theft has really been occurred and this information will be displayed using a 16x2 LCD and this time the power will be cut down and fine will be imposed on the illegal consumer.

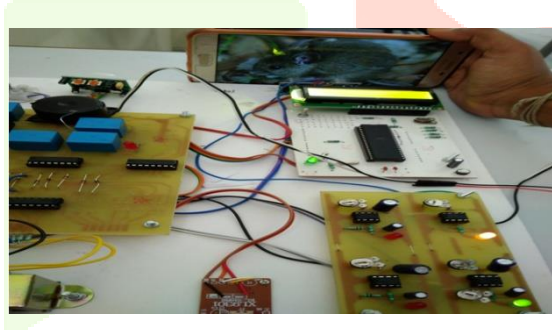


Fig-7.4: Rodent Siren Technology - When the rodents enter the field, the ultrasonic sensor detects the movement of the rodents, an automatic signal is sent to the buzzer which emits sound which helps us in decreasing the nuisance of rodents.

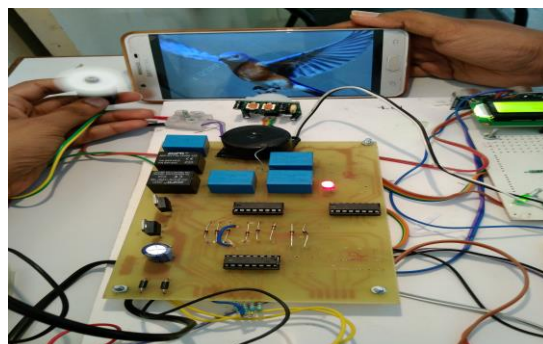


Fig-7.5: Bird Shoo Away Technology - When a bird enters the field, the level of infrared radiation in the field zone increases. The change detected is processed by the sensor. PIR sensor will keep processing the changes in infrared radiations and lightning will stay on. As soon as the movement of the birds is detected, DC motor mounted with the disc will start rotating and the birds will fly away.



Fig-7.6: Elephant Chase Away Pressure sensor measures the force per unit area of the elephants when they walked so that the movement of elephants is detected. An automatic signal is sent to the sprinkler by the sensor, which sprays the capsaicin on elephants which irritates them and prevents them from entering the field.

VIII. CONCLUSION

Electric theft detection has been designed and implemented with the proper combination of both hardware and software. Power theft using GSM has attracted much attention and has also been commercially used but 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 as elephant chase away, bird shoo and rodent's silent siren technologies which are not harmful have also been included to protect farmers field from huge crop loss and help them in achieving better crop yields thus improving their economic status. This project will help farmers in protecting their fields and save them from significant financial losses and will also save them from unproductive efforts that they endure for protecting their fields. We can successfully & effectively address the problems related to power theft by consumers, in a completely automated, wire-free, cost effective & most importantly in a reliable way.

IX. FUTURE SCOPE

As a further implementation to the developed model, we can assemble GPS module in order to identify exact location of power theft thereby identifying power theft at ease. Alert can be generated through GSM even in the case of failure of internet. For better network performance power theft can also be detected using PLC's. Fire sensor may be added to detect the accidental fire in the irrigation field.

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