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Smart Crop Protection System

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Abstract- *Agriculture is the backbone of the economy but because of animal interference in agricultural lands, there will be huge loss of crops. This article provides a comprehensive review of various methods adopted by farmers to protect their crops. The article also discusses use of modern technology in agriculture. Finally, this article reviews smart crop protection system using sensors, microcontroller and gsm module.*

Keywords - *microcontroller, sensors, GSM module, solar panel*

I. INTRODUCTION

Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds etc. This leads to huge losses for the farmer. Due to over population, it occurs a deforestation this results in shortage of food, water and shelter in forest areas. So, animal's interference in residential areas is increasing day by day which affects human life and property causes human animal conflict but as per nature's rule every living creature on this earth has important role in eco-system. Elephants and other animals coming in to contact with humans, impact negatively in various means such as by depredation of crops, damaging grain stores, water supplies, houses and other assets, injuring and death of humans.

So here we propose automatic crop protection system from animals. This is a microcontroller-based system using PIC family microcontroller. These systems use a motion sensor to detect wild animal approaching near the field. In such a case the sensor signal the microcontroller to take action. Traditional methods used by farmers are given below.

1.1. Electric Fences

Electric fences were used to control livestock in the United States in the early 1930s, and electric fencing technology developed in both the United States and New Zealand. An early application of the electric fence for livestock control was developed in 1936–1937 by New Zealand inventor Bill Gallagher. One of the major disadvantages of having an electric fence installed is that it requires regular maintenance. There are many rules and regulations involved, one that you need to check with local council to ensure even installing one is approved. Another is that you must constantly maintains the surrounding plant life. If trees and grass are not properly trimmed back, they could be considered a fire hazard.

1.2. Scarecrow

Scarecrow genealogy is rooted in a rural life style. The Egyptians used the first scarecrows in recorded history to use to protect wheat fields along the Nile River from flocks of quail. Egyptian farmers installed wooden frames in their fields and covered them with nets. While traditional, motionless scarecrows do work against "pest birds" (e.g., crows and blackbirds), the effect is almost always temporary. Over time, the birds get used to stationary dummies and resume their destructive habits.

Literature review.

One of the major economic issues faced by the country is agriculture as this is the sector which is source of livelihood for about 54% of Indians till date. Still today this sector is not well developed and faces lots of problems resulting into low productivity of crops.

As 43% of land in India, is used for farming but contributes only 18% of the nation's GDP. The poor condition of agriculture in the country is the point of concern for Indians. The rural farmers in India suffer from poverty and most of them are illiterate so there is lack of good extension services.

The problem of wild life attack on crops i.e., crop Vandalization is becoming very common in the states of Tamil Nadu, Himachal Pradesh, Punjab, Haryana, Kerala and many other states. Wild animals like monkeys, elephants, wild pigs, deer, wild dogs, bison, nilgais, estray animals like cows and buffaloes and even birds like parakeets cause a lot of damage to crops by running over them, eating and completely vandalizing them. This

lead to poor yield of crops and significant financial loss to the owners of the farmland. This problem is so pronounced that sometimes the farmers *decide* to leave the areas barren due to such frequent animal attacks

Another major problem faced by Indian farmer is their dependency on nature and poorly maintained irrigation system. Current agricultural practice are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low.

Poorly maintained irrigation system and almost universal lack of good extension service are among the factor responsible. Poor roads to market from village, rudimentary market infrastructure, and excessive regulation are few of the other concerned points for the agriculture sector in India.

The low productivity in India is a result of the following factor:

- According to World Bank's "India: Priorities for Agriculture and Rural Development", India's large agricultural subsidies are hampering productivity-enhancing investment. Over regulation of agriculture has increased costs, price risks and uncertainty. Government intervenes in labour, land, and credit markets. India has inadequate infrastructure and services. World Bank also says that the allocation of water is inefficient, unsustainable and inequitable. The irrigation infrastructure is deteriorating.
- Illiteracy, general socio-economic backwardness, slow progress in implementing land reforms and inadequate or inefficient finance and marketing services for farm produce.
- Very small (less than 20,000 m²) size of land holdings due to fragmentation, land ceiling acts and family disputes. Such small holdings are often over-manned, resulting in disguised unemployment and low productivity of labor.
- Illiteracy of farmers and their ignorance in the field of modern agricultural practices and technology, hampered by high costs and impracticality in the case of small land holdings.
- Inadequate Irrigation facilities and dependence of farmers on monsoon season, where good monsoon results in a vigorous growth while a poor monsoon leads to a sluggish growth for the economy as a whole.

Ministry of Agriculture is also working in direction to improve the conditions of farmers by employing different programs like Insurance plan and ITC Limited plan. Under Insurance plan Agriculture Insurance Company of India insures farmers cultivating wheat, fruit, rice and rubber in the event of natural disasters or catastrophic crop failure, under the supervision of the Ministry of Agriculture.

ITC Limited plan aims to connect 20,000 villages to the Internet by 2013 providing provide farmers with up-to-date crop prices for the first time, which should minimize losses incurred from neighbouring producers selling early and in turn facilitate investment in rural areas.

Problem identification

3.1. PIC Microcontroller

PIC (usually pronounced as "pick") is a family of Microcontroller made by Micro Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller,] and is currently expanded as Programmable Intelligent Computer. The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems. Early models of PIC had read-only memory (ROM) or field programmable EPROM for program storage, some with provision for erasing memory. All current models use flash memory for program storage, and newer models allow the PIC to reprogram itself. Program memory and data memory are separated. Data memory is 8-bit, 16-bit, and, in latest models, 32-bit wide. Program instructions vary in bit-count by family of PIC, and may be 12, 14, 16, or 24 bits long. The instruction set also varies by model, with more powerful chips adding instructions for digital signal processing functions

3.2. Buzzer

A buzzer is a loud noise maker. Most modern ones are civil defense or air- raid sirens, tornado sirens, or the sirens on emergency service vehicles such as ambulances, police cars and fire trucks. There are two general types, pneumatic and electronic. A buzzer or beeper is an audio Signaling device, which be mechanical,

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electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

- *Rated Voltage 6V DC*
- *Operating Voltage to 8V DC*
- *Sound Output at 10cm at 85dB*
- *Tone : Continuous*

Fig.2 Buzzer

3.3. GSM Module

GSM stands for Global System for Mobile Communications. It is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe pro- tools for second generation (2G) digital cellular networks used by mobile phone.

Fig.3. Gsm Module

3.4 Passive infrared sensor (PIR)

A passive infrared sensor (PIR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall. PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m Power is usually up to 5V.

Fig.4. Comparison 5 busbar (ribbon) with multi-busbar (wire) technology – increase absorption of light due to the reduction of shading based on the round wire design

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3.5. LCD Display

There are many display devices used by the hobbyists. LCD displays are one of the most sophisticated display devices used by them. Once you learn how to interface it, it will be the easiest and very reliable output device used by you. More, for micro controller-based project, not every time any debugger can be used. So LCD displays can be used to test the outputs. Obviously, for last possibility, you need to know how to use this stuff pretty well. Hitachi has set up a mile stone by its LCD controller IC. one of the IC s based upon the architecture introduced by Hitachi.

3.5. Laser Diode

A laser diode, (LD), injection laser diode (ILD), or diode laser is a semiconductor device similar to a light-emitting diode in which a diode pumped directly with electrical current can create lasing conditions at the diode's junction.[1]:3 Laser diodes can directly convert electrical energy into light. Driven by voltage, the doped p-n-transition allows for recombination of an electron with a hole. Due to the drop of the electron from a higher energy level to a lower one, radiation, in the form of an emitted photon is generated. This is spontaneous emission. Stimulated emission can be produced when the process is continued and further generate light with the same phase, coherence and wavelength. The choice of the semiconductor material determines the wavelength of the emitted beam, which in today's laser diodes range from infra-red to the UV spectrum. Laser diodes are the most common type of lasers produced, with a wide range of uses that include fiber optic communications, barcode readers, laser pointers, CD/DVD/Blu-ray disc reading/recording, laser printing, laser scanning and light beam illumination. With the use of a phosphor like that found on white LEDs, Laser diodes can be used for general illumination.

Description of study area

A systematic survey of 160 households in district was conducted to study the extent of crop raiding by wild animals. Almost all respondents (97.5%) reported crop damage by wild animals. Most crop damage was done by deer (91.1%). Farmers mostly used traditional nonlethal measures to secure their crops from wild animals. The most widely used measures were fencing (82.5%), guarding (75%), and scarecrows (71.9%). Farmers felt the need for the government to intervene- by providing permanent fencing materials (27.4%), legalizing killing (26.85%), introducing compensation schemes (18.3%) and investing in electrification of the field perimeters (17.7%).

Table 1. Animals involved in crop damage

Animals	Damage
Rabbits	Woody plants, Trees and Shurbs.
Deer	Foliage and Twigs and Bark.
Rats and Mice	Bins, granaries, corncribs and food-storage facilities.
Tree Squirrels	Gnawing wires and wood decks.
Monkey	Soyabean, Wheat, Maize.

4.1 Socio-economic background of farmers

The socio-economic backgrounds of farmers differed little across participating farms, with a mean age of 22 to 14years. Most farmers (71%) had attained a primary school education level, but only 29% had achieved higher. The average farm size and perimeter length was 3900m2_2300 and 890m_315, respect. Not correlated with distance to forest edge Farmers grew their crops for subsistence (56%) and commercial (44%) purposes. Among the subsistence crops edible to wildlife species, all farmers grew chickpea and wheat as their main crops, while banana, chili, maize, papaya plant and water spinach were among the other subsistence crops. The main commercial crops grown were wheat (62%), soybean (18%) or a combination of both (20%) crops, which are unpalatable to most mammal species. Most farmers thought that cutting down the forest would increase flooding (94%), soil erosion (88%) and attacks from insect crop pests (66%).

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4.2 Crop damage percentage

NAME OF THE VILLAGE	*CROP DAMAGE PERCENTAGE*
KINHIRAJA	44
VAKAD	25
ADOLI	10
KHANDALA	15
GOHGAON	6

Table 2. Number of. Damage occured

Project analysis

5.1 Block Diagrm

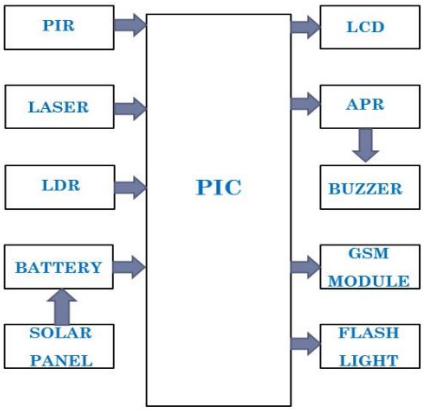

Fig.5. Block diagram of control panel.

In our proposed work, when the animal enters into the farm area. The LDR's placed in the vertical positions help us to detect the size of the animal whereas PIR sensors are used to detect position of the animal. Immediately, the APR board will be on, and the sound is played to divert the animal. During night time the flash light will be on and the message will be sent to the farmer. The LCD display the presence of animal and LDR readings. The GSM module is used for sending a message to warn the farmer about the intrusion.

Fig.6. Working

This device is using Embedded PIC Microcontroller. It comprises LCD (16×2) (JHD162A), PIC Microcontroller, PIEZO Buzzer, GSM based SIM900A module, rheostat (10k), battery 9v, LED. Whenever there is attack by animals by crops in agriculture field, this system detects sound produced by buzzer and generate SMS alert within seconds to field owner. This device is based on motion detecting sensor and is developed especially for crop monitoring in agriculture fields, farms, wet lands, for-ests etc. GSM technology is use to send SMS alert to user on mobile whenever there is fire broken out in field. It will also generate buzzer sound to alarm nearby people to take proper action to diminish crops protected by smart farming.

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The first major threat to the farmers is drought. Crop vandalization by animals is the second major threat after drought. Crops are vulnerable to animals. There- fore, it is very important to monitor the nearby presence of animals. The main aim of this project is to provide a better solution in order to resolve this problem. In this paper we proposed a method which could detect the presence of animal and offer a warning. In this project we used microcontroller and camera to detect the movement of animals send signal to the controller. It diverts the animal by producing sound and signal further, trans- mitted to GSM and which gives an alert to the owner of the crop immediately. The pro- posed monitoring scheme is to provide an early warning about possible intrusion and damage by animals.

Various methods aim only at surveillance which is mainly for human intruders, but we tend to forget that the main enemies of such farmers are the animals which destroy the crops. The problem of crop vandalization is a major threat to the agriculture as well as for humans. This leads to poor yield of crops and significant financial loss to the owners of the farmland. This problem is so pronounced that sometimes the farmers decide to leave the areas barren due to such frequent animal attacks. This system helps us to keep away such wild animals from the farmland and it is also an automated depend- ing on the need so that there is no manual work, thereby saving time and also preventing the loss of crops.

5.2 Simulation

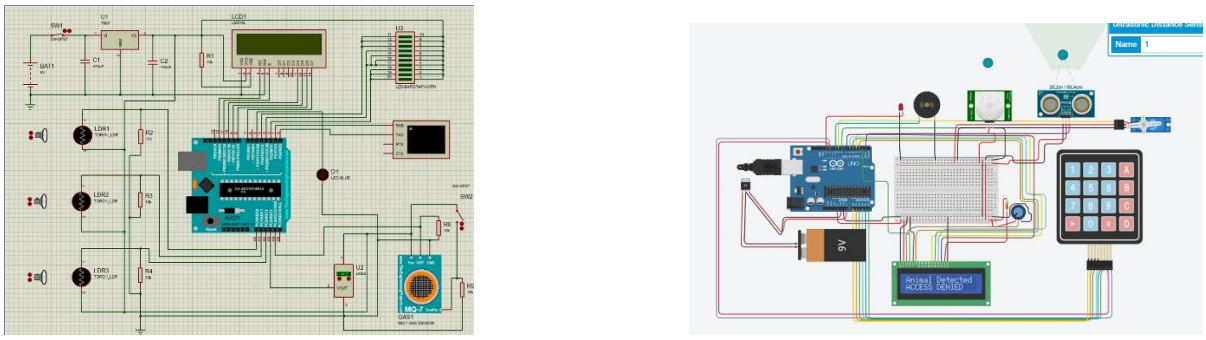

Fig.6. Experimentation work

Tool used: Proetus 8
Platform used: Windows 10 64bit
System Configuration: i5 7th gen
Results: Positive

Conclusion

The problem of crop vandalization by wild animals and fire has become a major social problem in current time. It requires urgent attention as no effective solution exists till date for this problem. Thus, this project carries a great social relevance as it aims to address this problem. This project will help farmers in protecting their or- chards and fields and save them from significant financial losses and will save them from the unproductive efforts that they endure for the protection their fields. This will also help them in achieving better crop yields thus leading to their economic wellbeing.

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