IOT Based Wireless Sensor Network for Prevention of Crops from Wild Animals

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***Abstract* — Wildlife requirement overlaps human population, creating cost to residents and cultivated field. Wild animals often destroy standing crops, due to which annual production of crops reduces causing economic losses to farmers. In our region, farmer suicide is big problem due to low productivity among farms. This low productivity is because of two main reasons i.e. Crop destroyed by wild animals and Crop destroyed by nature object. This paper provides review for complete technical solution using wireless sensor network (WSN) and Internet of Things (IOT) to the farmers to prevent their crops from wild animals. It includes all the types of sensors, controller, actuator required for WSN and raspberry pi as a heart of the system.**

***Key Words* — WSN, IOT, Raspberry pi, Webcam**

I. INTRODUCTION

The conservation of crop field from the wild animal has been a main aim of this paper. The animals from the wild area are continuously attacking to crop from so many years and the protection of this crop field from wild animals is the serious issue. The wild animals face an shortage of water and food due to which they move towards the agriculture area which creates great loss to the crops and annual income of farmers, when wild animals enter in a farm there is a need for an alert system to prevent crops from damages from wild animal. The proposed paper is completely technical solution for each farmer using **wireless sensor network** (WSN) and Internet of Things (IOT). This paper focuses on algorithm to detect the presence of animals near the crop field. The main heart of the system that is used here is the Raspberry pi which is a widespread platform and the WSN. The Raspberry Pi is a sequence of credit card–sized single-board computers established in United Kingdom by the Raspberry Pi Foundation. A **wireless sensor network** (WSN) consists of a large number of autonomous sensors to cooperatively monitor physical or environmental conditions. A typical WSN consists of various clusters connected with the sink node. Each cluster has number of sensor nodes having one Master node capable of collecting the data from remaining nodes. Each Sensor node requires four basic units i.e. sensing unit, processing unit, transceiver unit and a power unit, every node will have all the sensors required to detect wild life activity so as the necessary action will be taken by actuator so that the wild animals will run away. The position of the animal once detected is tracked by ultrasonic sensor then raspberry pi take an image of animal using camera, this image is send to the user using GSM.

II. SYSTEM OVERVIEW

i] The first method of implementation of proposed system is to design low cost wireless sensor node. A **wireless sensor network** (WSN) consists of a large number of autonomous sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants. Wireless sensor networks are widely used in tracking and surveillance applications. A typical WSN consists of various clusters connected with the sink node. Each cluster has number of sensor nodes having one Master node capable of collecting the data from remaining nodes. Each Sensor node requires four basic units i.e. sensing unit, processing unit, transceiver unit and a power unit

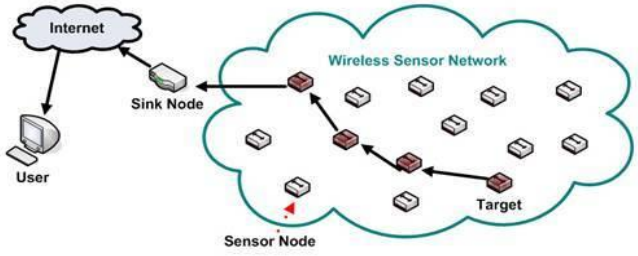

Fig. a] Component of Sensor Node

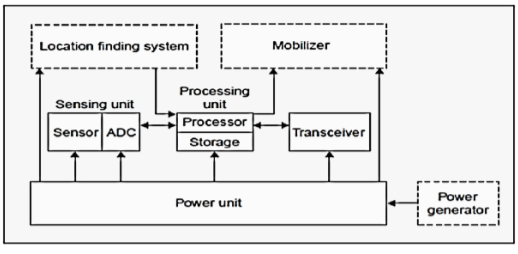

Fig. b] Typical view of WSN

Thus, every node will have all the sensors required to detect wild life activity so as the necessary action will be taken by actuator so that the wild animals will run

away. Similarly, all the data of each and every sensor will be stored to the cloud for further analysis.
ii] Arduino Controller: Arduino UNO or MEGA 2560 can be used as per requirement.
iii] Bluetooth protocol: Bluetooth modem HC-05/06 can be as wireless protocol for transmission of data.

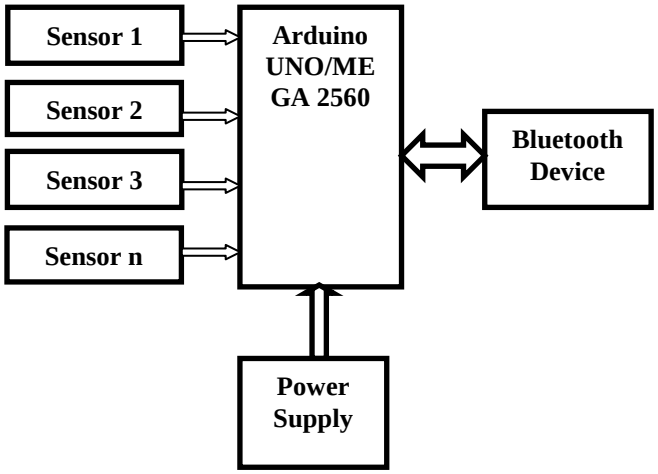

Fig.c] Wireless Sensor Node

Designing of Master node

Master node within a cluster has the capability to sense the data from remaining sensor nodes. It means that the sensing ability and processing power of master node must be higher than the other sensor nodes within a cluster. So instead of using Arduino controller, the proposed system thinks to use the Raspberry pi-3 as a heart of the master node system.

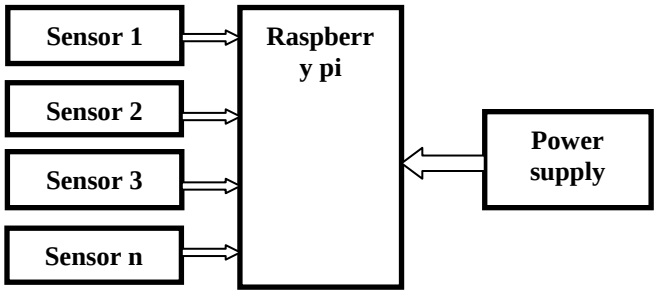

Fig. d] Wireless Sensor master mode

Here Raspberry Pi 3 is a small credit card size computer and have inbuilt Bluetooth and Wi-Fi protocol. It has the ability to run several applications at a time with memory storage of desired size. So, this designing of wireless sensor Master node using Raspberry Pi-3 can cause the costing up to max 5000 INR.

Preparation of single cluster:

The WSN cluster will consists of one Master node sensor and remaining Arduino based sensor node. The proposed system has to analyse the data for minimum two clusters having 8-10 nodes.

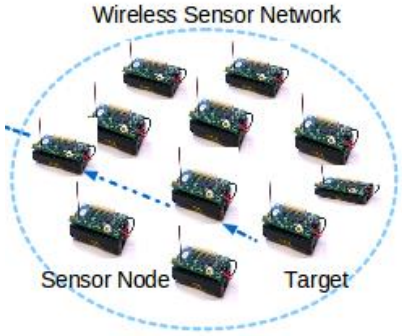

Fig.e] Single Crystal of WSN

Designing of Sink node

Sink node has the capability to sense the data from several clusters. It means that the sensing ability and processing power of sink node must be similar with Master sensor nodes within a cluster. So again the proposed system thinks to use the Raspberry pi-3 as a heart of the sink node system

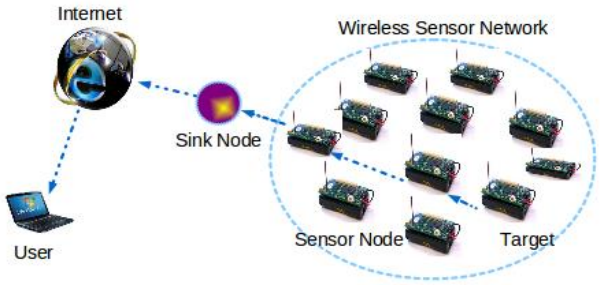

Fig. f] wireless sensor network

Designing of WSN (at least 2 clusters) through IOT.One cluster of WSN is able to serve for minimum of 3 hector of area based on the wireless protocol is to

be used. Such two clusters will be designed and checked for total 6-7 hector of area.

Designing of cloud to store all the collected data for further analysis.For storing the data of all the sensors, designing of cloud is a prime factor. All the data stored will be saved and analysed to provide number of conclusions for number of area to each connected farmer.

IoT(INTERNET OF THING):

The term "The Internet of things" was coined by Kevin Asthon of Procter and Gamble,later MIT's Auto-ID Center in 1999.The Internet of things (IoT) is the internetworking of smart devices ,vehicles (also referred to as "connected devices" and "smart devices"), buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. "The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities.

"Things", in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animal etc .Each thing is uniquely identifiable through its embedded computing system but it is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 30 billion objects by 2020.

Year 2025-with the same base of 525 million farms, there will be 600 million sensor in use at these farms-representing major shift towards technological advancement being applied to agriculture to support the agriculture Internet of things.

Year 2035-with 525 million farms globally,there will be a more than threefold growth in sensor usage compared to the year 2020.

III. ALGORITHM

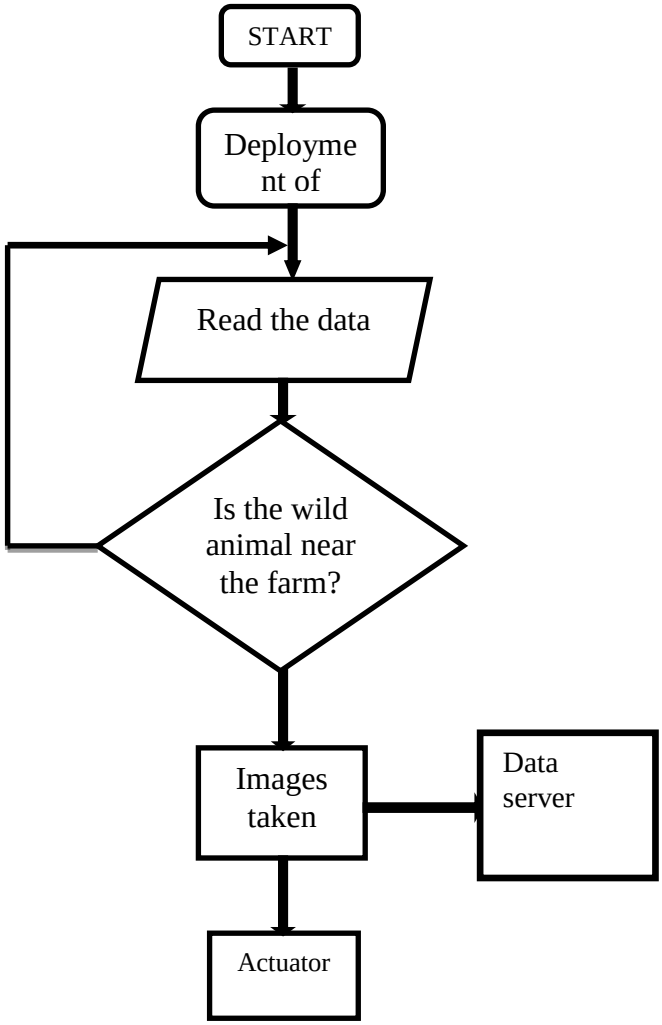

Fig g]: Flow of system

Detection of Animal using Webcam and Pi:

A block diagram representation of the proposed approach has been shown in Fig. In that system web camera is use to capture the image of wild animal in cultivated area.

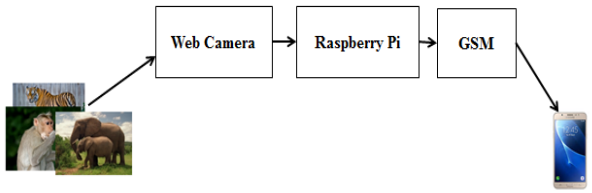

Fig h]: Basic block diagram

The Fig. shows web camera and GSM connected to the raspberry pi kit .Camera is used to detect the motion of wild animal and ones it get detected it captures its image and distinguish its features is it dangerous or not, if it is dangerous then it sends instant message to the farmer.

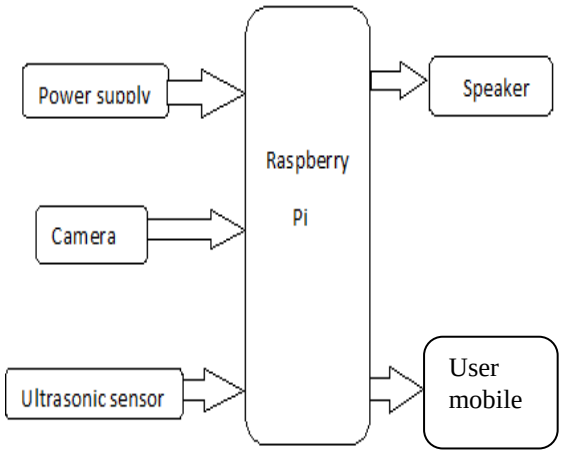

Fig i]: Functional Block Diagram of the Project

Camera module: Camera interfaced to the raspberry pi module. Which is used to captures an image of wild animal and send captured image to the Raspberry pi module.

Raspberry pi module: Raspberry pi module is small credit card size CPU. When image taken by the raspberry pi it is compared with database image. After comparing images if the wild animal is detected then it gives commands to GSM module.

GSM module: GSM module is used to sending a message to farmers. GSM used to send the message to the owner of the farm .

Speaker module: The image of wild animal is captured by a camera which is given to the raspberry pi, to get the output in the form audio we have connected speaker to the raspberry pi.

CONCLUSION

The problem of crop destruction by wild animals has become a serious problem for the farmer. Effective solution and urgent attention is needed to solve this serious problem. To solve the problem of farmer we have designed a smart farmland protection system with the help of IOT. The main aim is to prevent the loss of corps and protect the area from wild animals which causes major damage to the agricultural area. So our technical approach will be helpful to the farmers in protecting fields and save them from financial losses and also saves them from unproductive efforts that they endure for the protection of their fields.

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