<center>**Project Design Phase-I**</center>

<center>**Proposed Solution**</center>

Date	24 September 2022
Team ID	PNT2022TMID34928
Project Name	IOT BASED SMART CROP PROTECTION SYSTEM
Maximum Marks	2 Marks

Proposed Solution :

S.No.	Parameter	Description
1	Problem Statement (Problem to be solved)	In Agricultural field human-animal conflict is a major problem where enormous amount of resources are lost and human life is in danger. Due to this People lose their crops, livestock, property, and sometimes their lives. In many countries like the USA, Australia, Canada and India, the farmers and crop field owners have been facing a problem of trespassing of wild animals for which no feasible solution has been provided. Farmers have to stay up all night to manually scare the animals away. Heavyweight animal species like elephants, bears, and pigs often trespass for grazing and destroy the crops in the process. Smaller wild animals like monkeys, oxen, horses, and deer also have a significant contribution to the same. Installing a fence or barrier like structure is neither feasible nor efficient due to the large areas covered by the fields. Also, if the land owner can afford to build a wall or barrier, government policies for building walls are often very irksome.The amount of capital loss is enormous and has to be eliminated. So this zone is to be monitored continuously to prevent the entry of wild animals. Although India is the second largest irrigated country of the world after China, only one-third of the cropped area is under irrigation. Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic. India cannot achieve sustained progress in agriculture unless and until more than half of the cropped area is brought under assured irrigation. Most of the Indian irrigation system is manually operated hence it requires a large amount of the water for irrigation. The farmers had used different techniques to overcome the wastage of the water during irrigation but it did not meet the expectation

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		hence it is necessary to improve the productivity of the crop by using limited water resources.
2	Idea / Solution description	The idea is to significantly reduce the crops destroyed annually and completely automate the security of the field. The idea is to solve the problem by placing long range CAMERAS at the corners of the field or land while considering the maximum field of view of the camera.This idea makes use of Computer Vision for identifying and classifying trespassed wild animals and cattles. Speakers with an equal amount of distance between them are placed inside the field. The positions of the camera and the speakers are static.The motion of any wild animals or intrusion by humans can be detected using a PIR sensor. Fig: PIR sensor Fig: Camera Once the motion is detected by the PIR sensor, the camera has to be turned ON and the information has to be sent to the cloud data storage. The video from the camera is captured and broken down into frames which are then sent sequentially to the object detection module. The time interval between the successive frames goes up to 1.5 seconds depending on the hardware acceleration. A 1.5 seconds lag would not significantly affect the efficiency of preventing the animals from entering the field.The distance at which the animal is present in the field can be found by using a ULTRASONIC sensor.
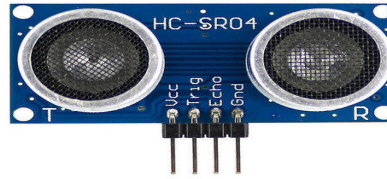
Fig: Ultrasonic sensor

When an animal enters the field of view of the camera, the object detection module would first classify if it is a potential threat to the farm. If the animal is classified as a threat, the distance between the animal and the speakers inside the farm which are in the field of view is calculated to decide which speaker should make a sound, the speaker closest to the animal is identified by filtering the other speakers with a larger distance. The recorded image is compared with the images of the animals that are stored already in the cloud. This is done with the help of OpenCV Image processing package for python. Once the image matches with the stored images, the alert message is sent to the forest department with the help of a messaging API and land owners also get the alert through mobile application.
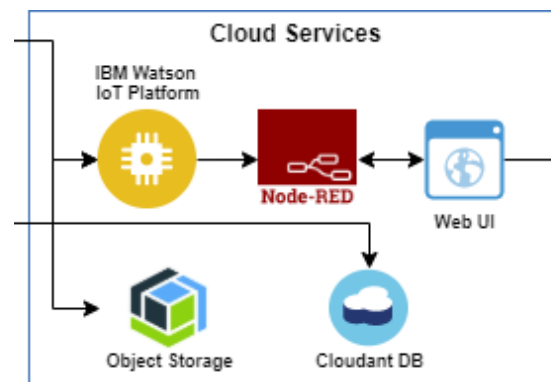

Fig: Cloud Services

Developing a Smart Crop Protection System from Animals, some steps need to be followed to achieve this successful task. The steps are definable as follows:
1. Motion detection
2. Image capturing
3. Image processing
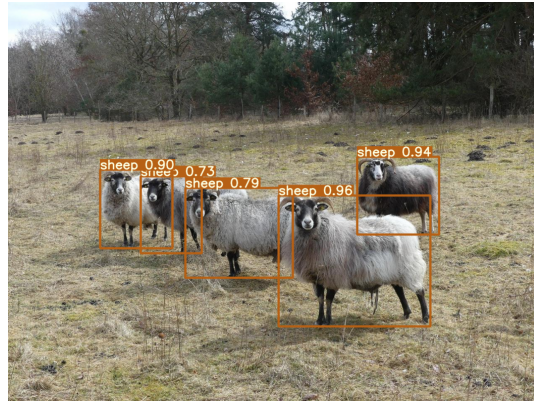4. Alert generation
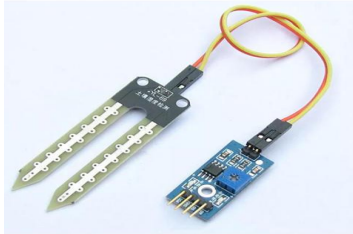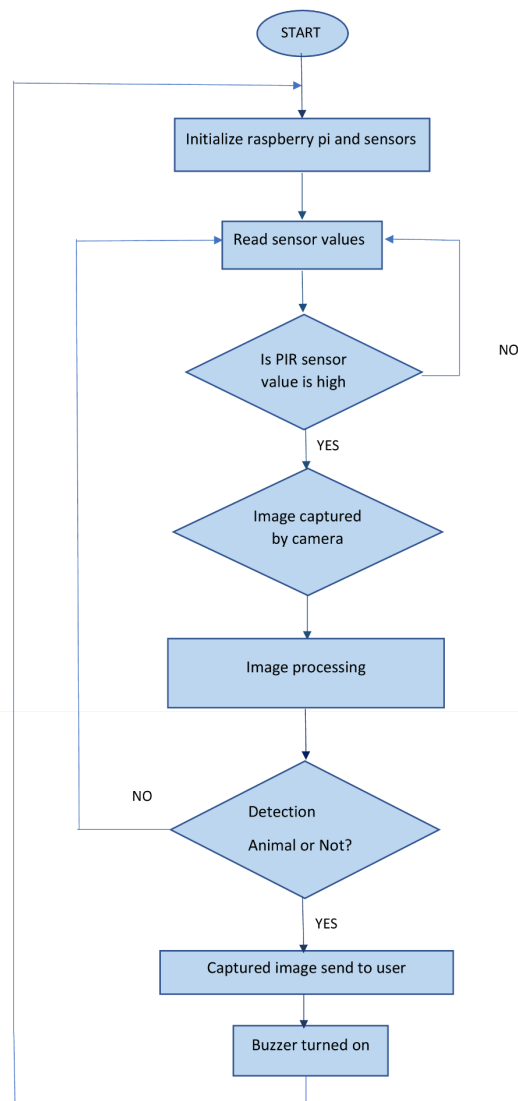
Fig:Animal detection using computer vision

Fig: Flow chart of proposed system

The design proposed also includes an automatic system which assists the farmer in the irrigation process. It keeps alerting the

farmer via messages sent to the mobile of farmers. The Idea is to focus on detecting wild animals along the farm's border and also saving water by switching on and off the motor based on soil moisture content. Here we use SOIL MOISTURE sensors to detect moisture content in the farm and controllers to collect sensor data. The controller analyzes the data and based on that data, sends the signals to turn on and off the motor based on the soil's moisture content through the soil moisture sensor information.

Fig: soil moisture sensor   Fig: ESP8266

The sensors capture the data and send it to the controller then the controller collects the data from the sensors by using the Wifi module(ESP8266) and sends that data to the cloud server. Server processes the data received from the controller and sends the signals to the actuators, and mobiles of the users. Then the actuators perform the actions based on the data from the server.

3	Novelty / Uniqueness	**Existing Work:** Boundary walls and solar fences around the sensitive areas are built to prevent the wild animal attacks. But this system doesn't allow the animals to have a large living range and in-dependence of movement. Overhead or underground structures are built to divert the wild animals into a different path not interfering with vehicle traffic. But this system takes longer duration, labor and moreover not economical and satisfactory. Some devices of information technology viz radio collars with very high frequency, global positioning system and satellite uplink facilities, are being used by the research institutions to monitor the movement of lions, tigers, elephants and other wild animals to understand their movements and their use pattern of the habitat. But installation of the system becomes difficult and is not always possible. **Highlights of our Proposed Work:** 1. When the animal enters the farm area,the PIR and ultrasonic sensor detect the presence of the animal and send an input signal to the controller.

		2. The controller switches on the camera. The video from the camera is captured and broken down into frames which are then sent sequentially to the object detection module which would first classify if it is a potential threat to the farm.
		3. If the animal is classified as a threat, the distance between the animal and the speakers inside the farm which are in the field of view is calculated to decide which speaker should make a sound, the speaker closest to the animal is identified by filtering the other speakers with a larger distance. Thus the sound from that particular speaker is played to divert the animal which leads to less power consumption.
		4. During night time the flash light will be on and the message will be sent to the forest department and the farmer.
		5. Power supply will be given by the solar panel or from regulated power supply.
		6. The Wifi module is used for sending alerts and notifications to the farmers. It helps to reduce human labour.
4	Social Impact / Customer Satisfaction	With the help of our proposed work, current problems associated with farming are solved by reducing human efforts, wastage of water, and giving live updates to the farmer about the condition of the field on the mobile device. The major goal of our project is to safeguard crops from damage by the animals and to divert animals without harming them. Some of the other benefits of our project to the society are as follows: ● Conservation of water. ● Optimization of energy resources. ● Better crop yield eliminates human errors. ● Low power consumption. ● Ensure the safety of animals. ● To perform in real time. ● Increased sales price. ● Reduce the workload of farmers.
5	Business Model (Revenue	Due to improved quality compared to other food items sold in the market, the sale price of food products grown using the

	Model)	latest advanced technologies is higher and generates more revenue for the farmers.
		
		      Adopting a smart crop protection system based on IOT is one the most helpful developments for farmers in standing against the growing global population's increasing demand for quality food. The adoption of a smart crop monitoring system gives farmers a variety of important benefits and will also help in generating better revenue compared to traditional monitoring systems.
		
		      Once a successful model for Smart Crop Protection is completed, it can be sold to agricultural contract companies and also to the small and large scale farmers with the necessary financial support (like incentives to farmers) from the state and central government. By the above process we can make revenue, at the same time we can help the farmers to increase their productivity and subsequently their income can also be increased.

6	Scalability of the Solution	Most IoT devices are expected to be deployed outdoors (in fields and farms). Harsh work environments lead to the rapid degradation of IoT devices' quality and can lead to unexpected manufacturer failures. The mechanical safety of IoT devices and systems must be ensured so that they can withstand extremes of weather, such as temperature, humidity, rainstorms, and floods. In our opinion, new materials and technologies need to continue to be studied to improve the durability of devices. For the purpose of enhancing feasibility, IoT devices use the solar-powered system and communicate with the monitoring center based on the LoRa network. From this it is concluded that the design system is very useful and affordable to the farmer. The design system will not be dangerous to animals and human beings and thus protects the farm.