Team Name : ರೈತ 1.0

	Name	Branch and Semester	Contact Number	Email- ID
Team Leader	K O PRAPHUL	Electronics and instrumentation (8th semester)	9902643364	praphul07babu@gmail.com
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Note:

1. One can participate either as a part of a team or an individual basis. Switching teams is not allowed.
2. The uploaded ideas will be screened to go to the second round.
3. Judging : competition entries shall be judged, or winners selected based on the following criteria
   - Is the problem worth solving
   - How innovative or novel is the idea
   - Scientific accuracy
   - Social impact
   - Scalability
4. Decisions of IIC JSSSTU in respect of all matters to do with the competition will be final and no correspondence will be entertained.
5. In second round, the selected teams will have to present their idea in front of the jury panel.
6. Payment of INR 50 should be made to the UPI ID **anju.marina.lobo@oksbi** and submit the transaction ID above.
7. Idea should be submitted in **.pdf** format.

TITLE : "Increase farm income using AI based precision agriculture "

Abstract:

- Studies have shown that a properly configured irrigation system can reduce water usage by up to 62 percent or more over traditional irrigation methods.
- Need based watering of crops increases farmland health, promote deeper root growth, and make crops more disease resistant.
- The number of sensors required depends on many factors such as how your irrigation system is configured, how hydrozones(practice of clustering together crops with similar water requirements in an effort to conserve water) are laid out , it depends on the kind of topography of farmland, and the variety of crops that are grown.

Conventional method: When/how often to turn on the irrigation and how long to run/when to shut off the irrigation system is a laborious process ,less yield and high cost.

***My Main idea*:**

My Idea is to bring ***AI tech on to IoT device*** to acheive precision agriculture with the following benefits for our farmers.

Farmer Perspective	Tech Perspective
• Increase farm income • Increase the crop yield • Improve quality of crop • Optimize farm land usage, with right crops • Minimize water usage, pesticides • Minimize cost	• No cloud • No infrastructure • Less memory • On device analysis • No dataplan required • Precise decision at local level

- Firstly , train the AI model and it is done by using the dataset available from meteorological department from that particular district.
- The model will train itself over a period of time and makes decisions & suggestions to irrigate the crops at right times.

Introduction:

IoT Devices have severe resource constraints and lacks computing power– it just senses its environment and transmits the sensor readings to the cloud where all the decision making happens.

However we move the computation using AI models to IoT device and avoid costly infrastructure required for cloud setup .

This AI computation can be acheived by implementing **Bonsai algorithm on IoT device** with small memory footprint that itself is a breakthrough innovation.

About the algorithm:

- Bonsai, which can be trained on a laptop, or the cloud, and can then be shipped onto severely resource constrained Internet of Things (IoT) devices .
- Bonsai algorithm works with 2KB RAM
- Before deployment, the OS and all application code is flashed, leaving only a few KB for storing the trained ML model, prediction code, feature extraction code and associated data and parameters.
- After deployment, the only writable memory available is the 2 KB -16 KB of SRAM .

Motivation:

- An alternative paradigm where the IoT device can make predictions locally without necessarily connecting to the cloud .
- This enables many scenarios where it is not possible to transmit data to the cloud due to latency, bandwidth, privacy and energy concerns in rural areas .
- Making predictions locally would allow the device to work everywhere irrespective of cloud connectivity.
- Furthermore, alerts could be raised more quickly with local predictions than if all the sensor readings had to be first transmitted to the cloud.
- Since the energy required for executing an instruction might be much lower than the energy required to transmit a byte, making predictions locally would extend battery life significantly.

Methodology :

Following tables are comparision of how **accurate bonsai algorithm(implemented on IOT device)** is compared to other algorithms (with different dataset).

Method	Accuracy (%)	Model size (KB)
Bonsai with random initialization and without re-training	74.12	16
Bonsai without re-training	75.19	16
Bonsai	76.67	16
Bonsai with sparse PCA	58.32	16
Tree Pruning with sparse PCA	63.57	16
Decision Jungle with sparse PCA	61.67	16
RBF-SVM with sparse PCA	71.10	136

Resource-efficient Machine Learning in 2 KB RAM for the Internet of Things

Binary Datasets - Bonsai can sometimes outperform uncompressed methods with significantly larger models.

Dataset	Bonsai (%) 2KB	Bonsai (%) 16KB	GBDT (%)	kNN (%)	RBF-SVM (%)	NeuralNet (%)
RTWhale-2	61.74	61.74	56.95 (1172 KB)	51.75 (41143 KB)	53.82 (39905 KB)	52.26 (3910 KB)
Chars4K-2	74.28	76.67	72.38 (625 KB)	67.28 (6870 KB)	75.60 (6062 KB)	72.53 (314 KB)
Eye-2	88.26	90.31	83.16 (234 KB)	76.02 (14592 KB)	93.88 (7937 KB)	90.31 (6402 KB)
WARD-2	95.85	96.89	97.77 (1172 KB)	94.98 (17590 KB)	96.42 (7222 KB)	92.75 (3914 KB)
CIFAR10-2	73.02	76.64	77.19 (1562 KB)	73.70 (78125 KB)	81.68 (63934 KB)	75.90 (314 KB)
USPS-2	94.42	95.72	95.91 (234 KB)	96.70 (7291 KB)	96.86 (1660 KB)	95.86 (504 KB)
MNIST-2	94.38	96.47	98.36 (1172 KB)	96.90 (183750 KB)	98.08 (35159 KB)	98.33 (3070 KB)

Multi-class Datasets - Bonsai can sometimes outperform uncompressed methods with significantly larger models

Dataset	Bonsai (%)	GBDT (%)	kNN (%)	RBF-SVM (%)	NeuralNet (%)
Chars4K-62	58.59 (101 KB)	43.34 (9687 KB)	39.32 (6833 KB)	48.04 (7738 KB)	55.35 (1266 KB)
CUReT-61	95.23 (115 KB)	90.81 (2383 KB)	89.81 (10037 KB)	97.43 (8941 KB)	95.51 (1310 KB)
MNIST-10	97.01 (84 KB)	97.90 (5859 KB)	94.34 (183984 KB)	97.30 (39084 KB)	98.44 (4652 KB)

Here ,for us, the dataset is the information provided by the meteorological department.

- Experimental results on multiple benchmark datasets demonstrate that Bonsai can make predictions in milliseconds even on slow microcontrollers, can fit in KB of memory,has lower battery consumption than all other algorithms while achieving prediction accuracies that can be as much as 30% higher than state-of-the-art methods for resource-efficient machine learning.
- Bonsai has been deployed successfully on microcontrollers tinier than a grain of rice such as the ARM with just 2 KB RAM.
- Bonsai can also make predictions accurately and efficiently on the tiniest of IoT boards such as the Arduino Pro Mini operating at 8 MHz without any floating point support in hardware, with 2 KB RAM and 32 KB read-only flash memory.

Social Impact:.

- **Increase in farm income** as Indian agriculture sector accounts for 18 per cent of India's GDP and provides employment to 50% of the countries workforce.
- This inturn yields higher quality crops and increase the efficiency .
- When there is so much of data being trained and predicted by bonsai algorithm , all this data can be aggregated to help other farmers residing in similar kind of topography across the country .
- Since this consumes very less power , battery can potentially last upto many years.
- ***Also the data collected through this will be gold. It can predict very accurately when to irrigate , how much to irrigate according to the particular crop that is fed on the application developed .***

Market Survey:

In our country Agriculture heavily dependent on the monsoons.

Agriculture is said to be, "the gambling of the monsoon" as the monsoon rainfalls are uncertain, irregular and uneven or unequal.

- About 80 per cent of the total annual rainfall occurs in four months i.e. from mid-June to mid-October. So it is essential to provide irrigation for production of crops during the rest of the eight months.
- Soils of some areas are sandy and loamy and therefore porous for which a major portion of rainwater sinks down very quickly. This can’t retain water for longtime .
- The rain-water flows down very quickly along the slopes of hillsides.

Considering all these drawbacks , I feel with limited rainwater availability, water should be used very judicioulsy and optimally, hence **AI based precision agriculture** is imperative and my solution will make a major contribution towards agriculture and how it is practised.