Innovative IoT Based Precise Irrigation System for Agricultural Practices in UNESCO Geopark Ciletuh

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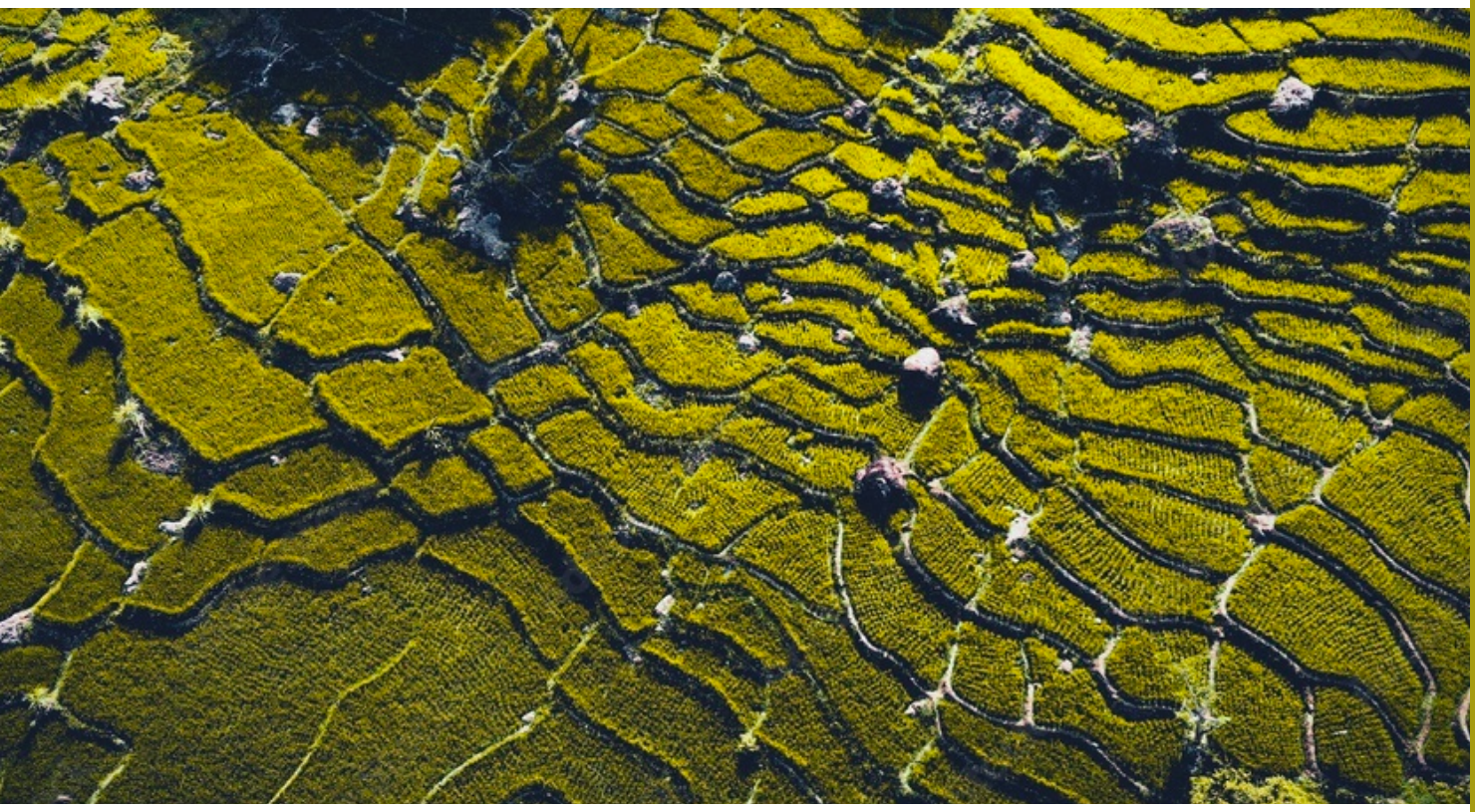

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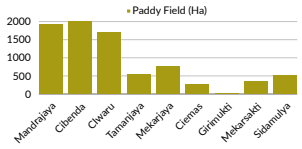
THE BIG IDEA

Project background and context
UNESCO Global Geopark Ciletuh, located in Sukabumi Regency, West Java, Indonesia, earned its UNESCO designation in 2018 for its rich geological heritage, biodiversity, and cultural significance.



In the heart of Sukabumi Regency's Ciemas district lies Mandrajaya, one of nine villages vital to the region's agriculture. Its fertile lands, nurtured by the mountain climate, sustain generations of farmers cultivating diverse crops. With 23% of the total paddy field area, Mandrajaya is a key contributor to Ciemas District's agricultural sector, shaping its identity and ensuring food security.

The changing climate greatly affects the occurrence of extreme wet and dry seasons, which in turn affects the irrigation of paddy fields and crop yields in certain parts of Ciemas District, especially in Mandrajaya Sub-District. And this is worsened by the implementation of conventional paddy irrigation systems that lack monitoring mechanisms, resulting in inefficient water usage.

Dealing with challenges like floods during heavy rains and droughts during prolonged dry spells remains an ongoing priority in balancing agricultural practices with environmental sustainability and ensuring the welfare of local residents.

Making Local paddy farmers in Geopark Ciletuh who still rely on conventional irrigation practices as our main beneficiary for this project.

Project Objecatives
As concerned stakeholder, we need to foster resilient and sustainable agricultural communities within the UNESCO Global Geopark Ciletuh, where local farmers thrive amidst climate challenges while preserving the natural and cultural heritage of the region.

By ensuring water availability, mitigating flooding, and promoting efficient farming, we empower farmers to increase yields and diversify income. Conservation efforts protect biodiversity and cultural heritage, fostering sustainable communities capable of adapting to climate challenges.

Project Approach and methods
We are confident that tackling this problem can be achieved through the installation of detention ponds, which will collect rainwater during the wet season and store it for use during the dry season to meet irrigation demands.

Additionally, to optimize water usage in irrigation, we utilize a 'precise irrigation system' integrated with IoT technology and diverse sensors strategically placed within rice fields to monitor water needs. This guarantees targeted water usage and minimizes wastage, thereby extending the longevity of water reservoirs in detention ponds and averting crop failures

Project Impacts

- Reduce irrigation water shortage for paddy fields in Mandrajaya Village during dry season. By Implementing water conservation methods like detention ponds (for long term), ensures a reliable water source for paddy farmers during dry spells, mitigating climate-related water scarcity and preserving crop yields.

- Mitigate flooding in the rainy season. These ponds capture excess rainwater, preventing field flooding. This proactive step protects crops from water damage, ensuring stable agricultural production despite climate variability.

- Encance water efficiency in rice cultivation. By utilizing precision irrigation systems with IoT technology optimizes water use by monitoring and adjusting irrigation based on crop needs, reducing waste and bolstering resilience to climate fluctuations.

THE PILOT

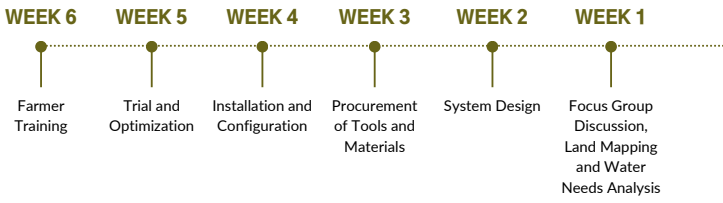
The Pilot Project
Mandrajaya Village, located in Ciemas District, Sukabumi Regency, West Java, requires an efficient irrigation system to support conventional agriculture. The small-scale concept implemented in the form of Precise Irrigation System based on Internet of Things (IoT) that can regulate irrigation in rice fields so that the use of water is more optimal. The following is the concept of small-scale implementation of the Precise Irrigation System based on the Internet of Things (IoT) that can be done in 6 weeks:

- Group Discussion, Land Mapping and Water Needs Analysis:
  - Conduct Group Discussions with stakeholders related to agricultural land that requires irrigation equipped with sensors and IoT devices.
  - Identify agricultural areas that require irrigation.
  - Conduct topographic mapping and analyze crop water requirements in each field.
  - Determine the location of sensors and IoT devices.
- System Design
  - Create an irrigation system design that takes into account topography, crop type, and crop water requirements.
  - Consider the use of flowmeter.
  - Determine the communication technology used in the IoT system.
- Procurement of Tools and Materials:
  - The process of procuring tools and materials in the IoT-based Precise Irrigation System in the form of pipes, ultrasonic sensors, soil moisture sensors, and controllers in irrigation.
  - Ensuring that IoT devices can be connected properly.
- Installation and Configuration
  - Install the sensors on the farm.
  - Connect the sensors to the controller through the IoT network.
  - Configure a web-based application to monitor and control the precise irrigation system.
- Trial and Optimization
  - This Precise Irrigation System is tested in stages, starting from the various sensors used to the one system. Monitor the sensor data in real time and send the data through a web-based application. Calibrate the system to match the standard based on the results of the trial.
- Farmer Training
  - Farmers are trained on the use of the IoT-based Precise Irrigation System, including how to operate it through a website-based application to control the irrigation system and also how to maintain the system properly.
  - The target audience for the training is all farmers, both conventional farmers and millennial farmers.

To address these issues and empower the village, we propose to scope down our project to focus solely on Mandrajaya. By concentrating our efforts here, we can ensure a deeper impact and create tangible improvements that directly benefit the villagers. This targeted approach allows us to tailor our solutions to their specific needs and foster sustainable development within Mandrajaya.

We aim to implement 5 set of our precise irrigation system as an innitial start. With this innovation, we can simplify monitoring to enhance the efficiency of water usage for irrigating rice fields. Consequently, irrigation channels can supply the appropriate amount of water to each rice field plot, reducing the risk of crop failure.

Pilot Project Timeline



THE PILOT

Stakeholder Mapping

For stakeholder mapping, we will engage with various entities, including the Head of RT & RW of Mandrajaya Village, the Head of Ciemas District, religious leaders, the Conventional Farmer Group, and the Millennial Farmer Group, to ensure comprehensive involvement and support for our project.

Budget Plan

No.	Events	Needs	Unit	Amount	Unit Price	Total
1	Precise Irrigation System based on IoT	Solar Panel	pcs	5	Rp200,000	Rp1,000,000
2		Flow meter	Pcs	5	Rp50,000	Rp250,000
3		Bracket	pcs	5	Rp200,000	Rp1,000,000
4		Arduino Uno	pcs	5	Rp150,000	Rp750,000
5		Modul Wifi	pcs	5	Rp50,000	Rp250,000
6	Operasional	Consumption	weeks	6	Rp700,000	Rp4,200,000
7		Pertamina Dex	Liter	100	Rp15,000	Rp1,500,000
8		Accomodation	Bundle	1	Rp1,200,000	Rp1,200,000
9	FGD	Leaflet	pcs	50	Rp3,000	Rp150,000
10		Consumption	pcs	50	Rp50,000	Rp2,500,000
11	Farmer Training	Leaflet	pcs	50	Rp3,000	Rp150,000
12		Consumption	pcs	50	Rp50,000	Rp2,500,000
13		Subscription Website	Bundle	1	Rp140,000	Rp140,000
GRAND TOTAL						Rp15,590,000