Project Plan for Bangkit 2023 Product-based Capstone

Problem Statement

Indonesia's food security score in the Global Food Security Index ranks 63 out of 113 countries with a score of 60.2 (source: BRIN). This is inversely proportional to Indonesia's status as an agricultural country. Limited infrastructure and water availability are the main problems faced by Indonesian farmers. Droughts cause water supply to decrease, river discharge decreases, water levels in lakes and reservoirs shrink, wells dry up so that people experience water shortages and some farms fail. Some people are forced to buy clean water to fulfill their daily water needs. Farmers also spent an additional 800,000 rupiah to rent a water pump and buy diesel to irrigate their rice fields. Some farmers modified their water pumps by replacing diesel fuel with 3 kg gas, saving 100-150 thousand rupiah. In addition to these two main factors, there are also temperature factors that have a direct negative impact on agricultural crops. Each plant has a minimum and maximum temperature limit for its growth process. Therefore the monitoring process is needed to maintain the standard temperature of the plant. The main factor of water availability can affect the success rate of farmers' harvests. The intensity of rainfall and the irrigation watering system set up affect the level of soil fertility on agricultural land. excessive rainfall or very low rainfall has a negative impact on the quality of agricultural soil fertility. Poor soil quality can affect farmers' crop yields. However, in terms of weather prediction, it cannot be done with a single monitoring, but needs to be monitored continuously because the weather is included in natural phenomena that are very difficult to guess. Adaptive irrigation watering systems must also be formed to be able to maintain good soil conditions.

Research question

- How to increase the probability of a successful harvest for farmers?
- How to maintain soil fertility using solar water pumps?
- What is the optimal temperature required for plants to grow optimally?
- What is the optimal air humidity for plants to grow optimally?

Team ID : C23-PC631

Team Member :

1. (ML) M148DSY2109 – Ayu Medina Prameswari – Bina Insani University - [Active]
2. (ML) M346DKX413 – Muhammad Rizki – Sriwijaya University - [Active]
3. (ML) M282DSX2308 – Rafki Afza Amri – University of Malang- [Active]
4. (CC) C330DSX2391 – Afrido Surietno Siringo-ringo – Riau University - [Active]
5. (CC) C055DSX1931 – Naufaldo – Politeknik Manufaktur Bandung - [Active]
6. (MD) A181DSX2450 – Javier Bintoro – University of Indonesia- [Active]

Project Plan for Bangkit 2023 Product-based Capstone

Final Selected Themes:
Food Accessibility, Agribusiness, and Food Security

Title of the Project:
TerraTech [Solar pump monitoring application using with IoT and sky images]

Executive Summary/Abstract:

Farmers have four main problems, namely: Water availability (linked to the season), pests, markets and credit. For the market, farmers are sometimes the losers. This is because the price of agricultural commodities in the market will drop due to the abundance of harvest stocks. However, when prices go up, farmers do not have agricultural products to sell, due to poor harvests or wrong determination of crop types. Climate change causes problems in agriculture, including farmers' difficulties in determining planting and harvesting schedules. Here we focus on the problem of farmers who depend on the availability of water, namely rainwater in the management of their crops, for this reason an irrigation system with a solar water pump was created by connecting it to an application for monitoring weather, data, temperature, air humidity, rainfall, soil fertility using an IoT box. By using a convolutional neural network algorithm to learn visual patterns in sky images related to certain weather conditions, such as clear, cloudy, or rainy skies. With implementation using TensorFlow or Keras to build and train CNN models for weather prediction with sky image classification.

How did your team come up with this project?
This project is based on the difficulties faced by farmers during the dry season, which have a direct impact on Indonesia's food supply, leading to a food crisis. Our project focuses on improving the solar-powered irrigation system, implementing an application for monitoring, controlling, and recording farmland data. The Terratech application can help farmers monitor the temperature and humidity levels of their land, as well as control water pump usage to prevent wastage, and the data can be recorded for future reference. The Terratech application aims to create a sustainable, efficient, cost-effective, and environmentally-friendly irrigation system that can improve crop yields.

Project Scope & Deliverables:

project scope	**in scope :** 1. Making IOT Tools to Capture sky images, capture soil Moisture data, and control pumps. 2. Provide information on temperature, air humidity,

Project Plan for Bangkit 2023 Product-based Capstone

	pump conditions, and soil conditions for farmers. 3. Predicts temperature based on captured sky photos. 4. Record for the pump **out scope :** 1. Added voltage parameter feature. 2. predict with time series for precision data for the captured sky photo by adding a data from bmkg. 3. adding user behavior in the mobile apps.
project deliverables	1. an android application to monitoring soil condition, air humidity, pump condition and temperature. 2. a system that can monitor agriculture soil and can control a pump from far. 3. A system that can predict temperature based on sky images every 15 minutes. 4. System manual for users. 5. IOT device with raspberry and camera, sensor and pump. 6. record for the pump (pump on schedule)

Project Schedule:

WBS (Work Breakdown Structure)

Link WBS :

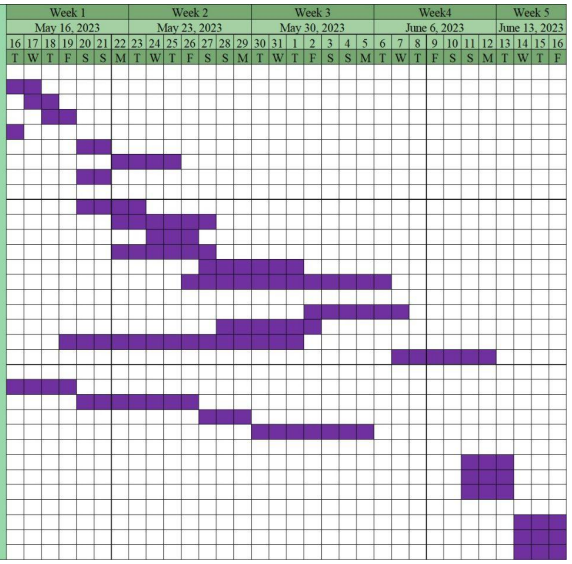
https://drive.google.com/file/d/105dY7ul-nF4Sf2mop6Bzd7RjXAEe4iqL/view?usp=sharing

Project Plan for Bangkit 2023 Product-based Capstone

Link Project Schedule:
https://docs.google.com/spreadsheets/d/18F6KaLI-8TwZLtX5p6ufWRUGwsrYubTW/edit?usp=sharing&ouid=111956175502945431338&rtpof=true&sd=true

Project Plan for Bangkit 2023 Product-based Capstone

No	Activities	Task Duration	Start	End
1	**Preparation**			
	1.1 Create a Workflow Programs	2 days	May 16, 2023	May 17, 2023
	1.2 Prepare Dataset, Preprocesss Image Data for Machine Learning	2 days	May 17, 2023	May 18, 2023
	1.3 Create Wireframe Application	2 days	May 18, 2023	May 19, 2023
	1.4 Create Git Repository	1 day	May 16, 2023	May 16, 2023
	1.5 Create Usecase	2 days	May 20, 2023	May 21, 2023
	1.6 Prototype Application/UI Design for Android	4 days	May 22, 2023	May 25, 2023
	1.7 Farmer Interview	2 days	May 20, 2023	May 21, 2023
2	**Finalization Mockup Application**			
	2.1 Cloud Architecture	4 days	May 20, 2023	May 23, 2023
	2.2 Authentication Feature for Android	6 days	May 22, 2023	May 27, 2023
	2.3 Database for Cloud Computing	3 days	May 24, 2023	May 26, 2023
	2.4 Make the model for Machine Learning	6 days	May 22, 2023	May 27, 2023
	2.5 Connect Machine Learning with GCP	6 days	May 27, 2023	June 1, 2023
	2.5 Create layout and function app, get and post data from Api	12 days	May 26, 2023	June 6, 2023
3	**Implementation and Evaluation**			
	3.1 Implementing GCP Service	6 days	June 2, 2023	June 7, 2023
	3.2 Dashboard Feature for Mobile Development	6 days	May 28, 2023	June 2, 2023
	3.3 Make the model for Machine Learning	14 days	May 19,2023	June 1, 2023
	3.4 Research Firebase, Deploy, Authentication	6 days	June 7, 2023	June 12, 2023
4	**Designing Hardware (IoT)**			
	4.1 Collect IoT Tools	4 days	May 16, 2023	May 19, 2023
	4.2 Program Tools	7 days	May 20, 2023	May 26, 2023
	4.3 Installation of Tools	3 days	May 27, 2023	May 29, 2023
	4.4 Testing the Tools	5 days	May 30, 2023	June 5, 2023
5	**Report**			
	5.1 Make video	3 days	June 11, 2023	June 13, 2023
	5.2 Edit video	3 days	June 11, 2023	June 13, 2023
	5.3 Create project presentation	3 days	June 11, 2023	June 13, 2023
6	**Maintenance**			
	6.1 Testing with postman for Cloud Computing	3 days	June 14, 2023	June 16, 2023
	6.2 Testing for Machine Learning	3 days	June 14, 2023	June 16, 2023
	6.3 Testing for Mobile Development	3 days	June 14, 2023	June 16, 2023



Based on your team's knowledge, what tools/IDE/Library and resources that your team will use to solve the problem?

Dataset
• https://www.kaggle.com/code/irenepalebangan/klasifikasi-gambar-langit-setelah-eksperimen/input • https://www.kaggle.com/datasets/somesh24/multiclass-images-for-weather-classification?resource=download

IoT	Project Management	Design
• Node MCU • Camera • Raspberry pi 3b+ • Soil moisture sensor • Pump DC • Relay DC • Power Supply	• Trello • Github	• Figma • Draw.IO

Machine Learning :	Mobile Development :	Cloud Computing :

Project Plan for Bangkit 2023 Product-based Capstone

• TensorFlow keras • Prophet • Scikit-learn • Python Notebook • Regression Linear • neural network • Flask • Camera to capture the sky (additional)	• Android Studio • Kotlin	• NodeJS • Visual Studio Code • Postman • Google Cloud Platform

Based on your knowledge and explorations, what will your team need support for?

- Dataset
- GCP budget
- Mentor for ML
- Mentor for CC

Based on your knowledge and explorations, tell us the Machine Learning Part of your Capstone!

We'll take a set of sky image data from kaggle plus our sky images to train & validate the data using CNN algorithm and tensorflow framework. By creating model with rainy, cloudy, overcast, and clear sky data. The data is tested by obtaining images at regular intervals within 15 minutes.

Based on your knowledge and explorations, tell us the Mobile Development Part of your capstone?

Define requirements for the app, create wireframes and mockups using figma, develop it using kotlin and android studio, test its functionality, and deploy it for distribution to users. Features include remote pump control and real time monitoring of soil moisture, lighting, and temperature.

Based on your knowledge and explorations, tell us the Cloud/Web/Frontend/Backend Part of your capstone?

We will use Raspberry pi to take pictures and send the results of the image to google cloud storage to be processed, and take some data such as soil and pumps, and send it to sql based storage at GCP. And API used is NodeJS using the expressJS framework.

Project Plan for Bangkit 2023 Product-based Capstone

Based on your team's planning, is there any identifiable potential Risk or Issue related to your project?

Internal

- Team members' activities outside the Bangkit program such as thesis and internships
- Whether we can blend in and work as a whole team or not
- Our individual ability to carry out the jobdesk for each person

External

- Additional datasets that we take must be taken independently
- Other teams that have the same idea as us
- Budget IoT by our member
- the camera is dead or broken
- if we want to be good and more advanced, use a camera that can rotate 360 degrees

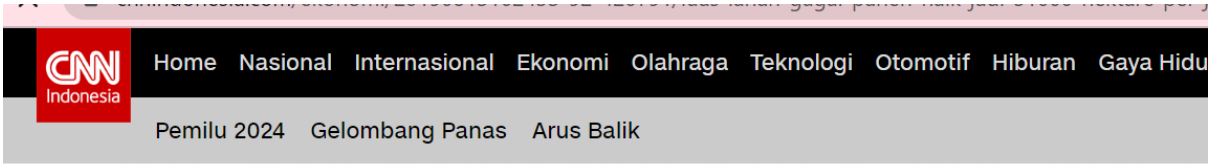
Any other notes/remarks we should consider on your team's application

Terratech comes with a series of features for monitoring, controlling and recording data on the results of monitoring that can help farmers in preventing food crises and increasing agricultural yields. In the future we plan to work with companies to help process their products to reduce production costs, be more environmentally friendly by reducing the use of excess water and electricity through the use of solar panel technology, and optimizing crop production. We will continue to develop features and bring innovations every year if the work is facilitated, and the project is fully finalized, it will help support the SDGs.

Appendix

Source of the latest news and data

Project Plan for Bangkit 2023 Product-based Capstone



Home > Ekonomi > Bisnis

Luas Lahan Gagal Panen Naik Jadi 31.000 Hektare per Juli

CNN Indonesia

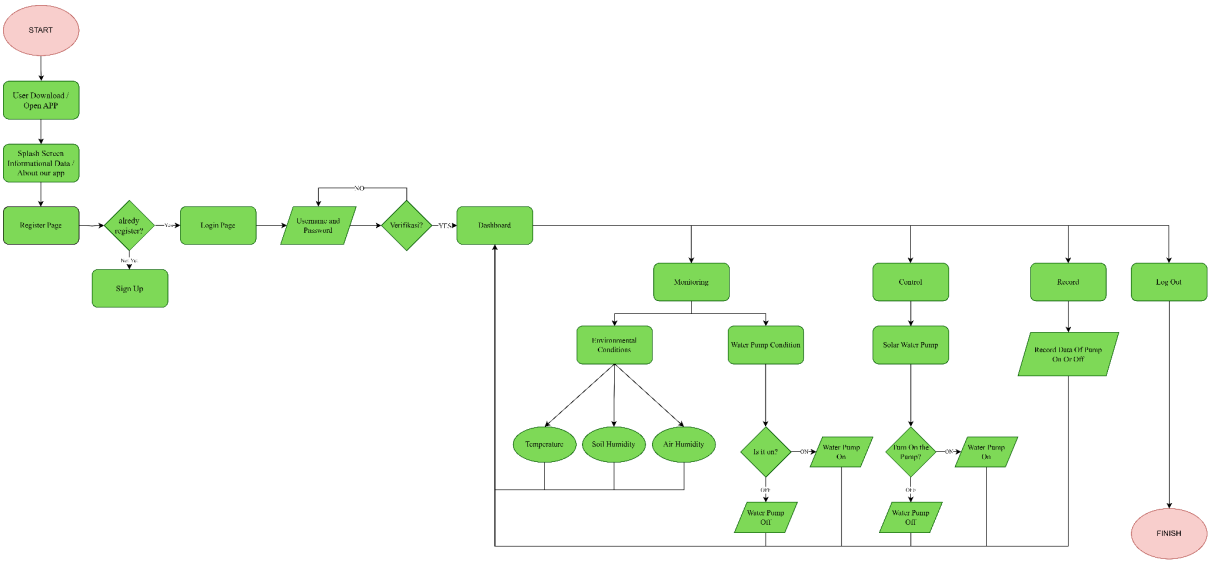
Selasa, 13 Agu 2019 10:44 WIB

Bagikan :

Project Plan for Bangkit 2023 Product-based Capstone

Logo Terratech

Flowchart
Link Flowchart :
https://drive.google.com/file/d/1DcjA6kXEhg6AFWzlrs6Z_k3RYjrCcFQ_/view?usp=sharing



Architecture for IoT

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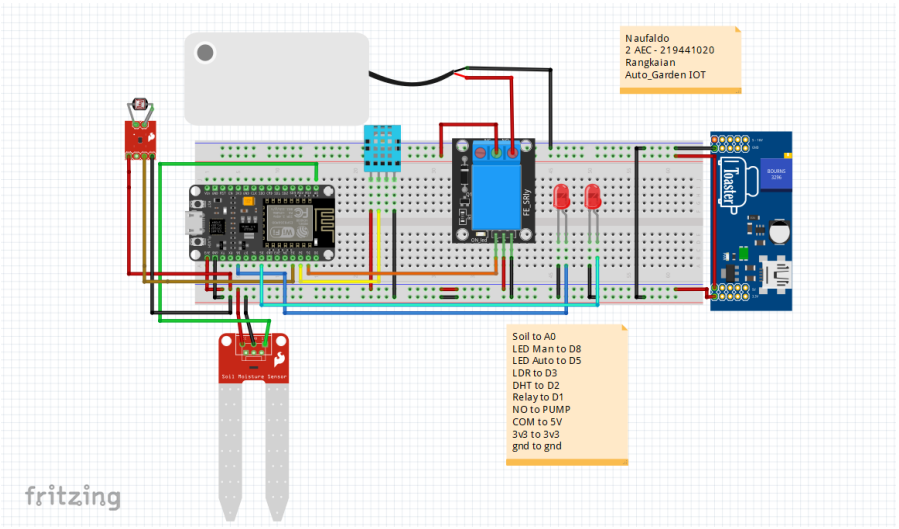
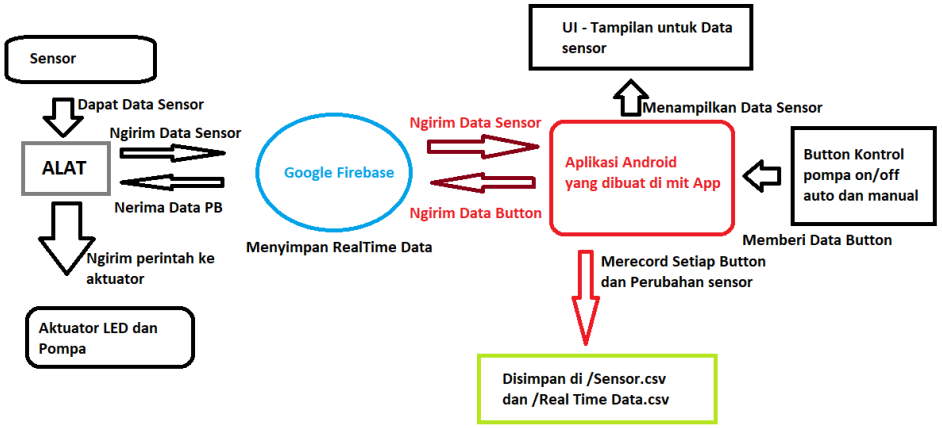


TERRATECH

How the tools work

This is an overview of the IoT that we will create. Which parts of IoT are interconnected, starting from sensors to detect soil moisture, sensors to detect air humidity, and sensors to detect temperature which will be processed by IoT and produce data that will be displayed on the Terratech Application.



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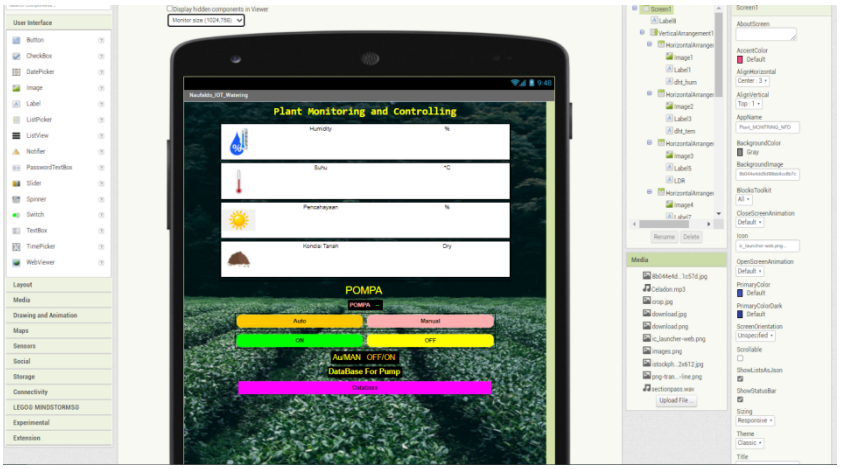

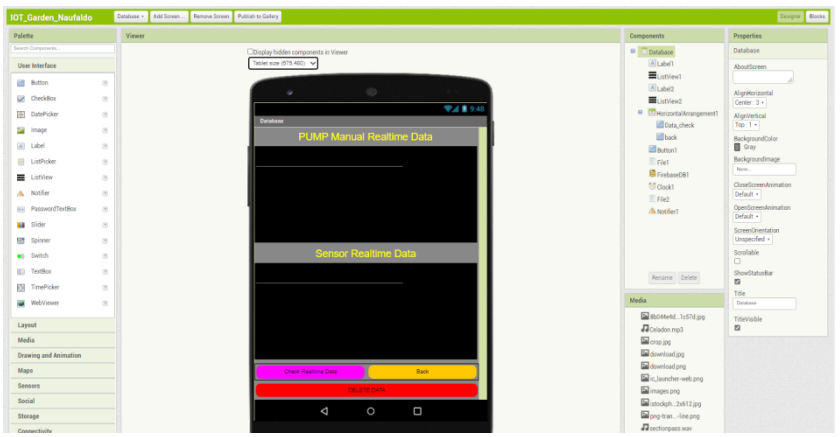

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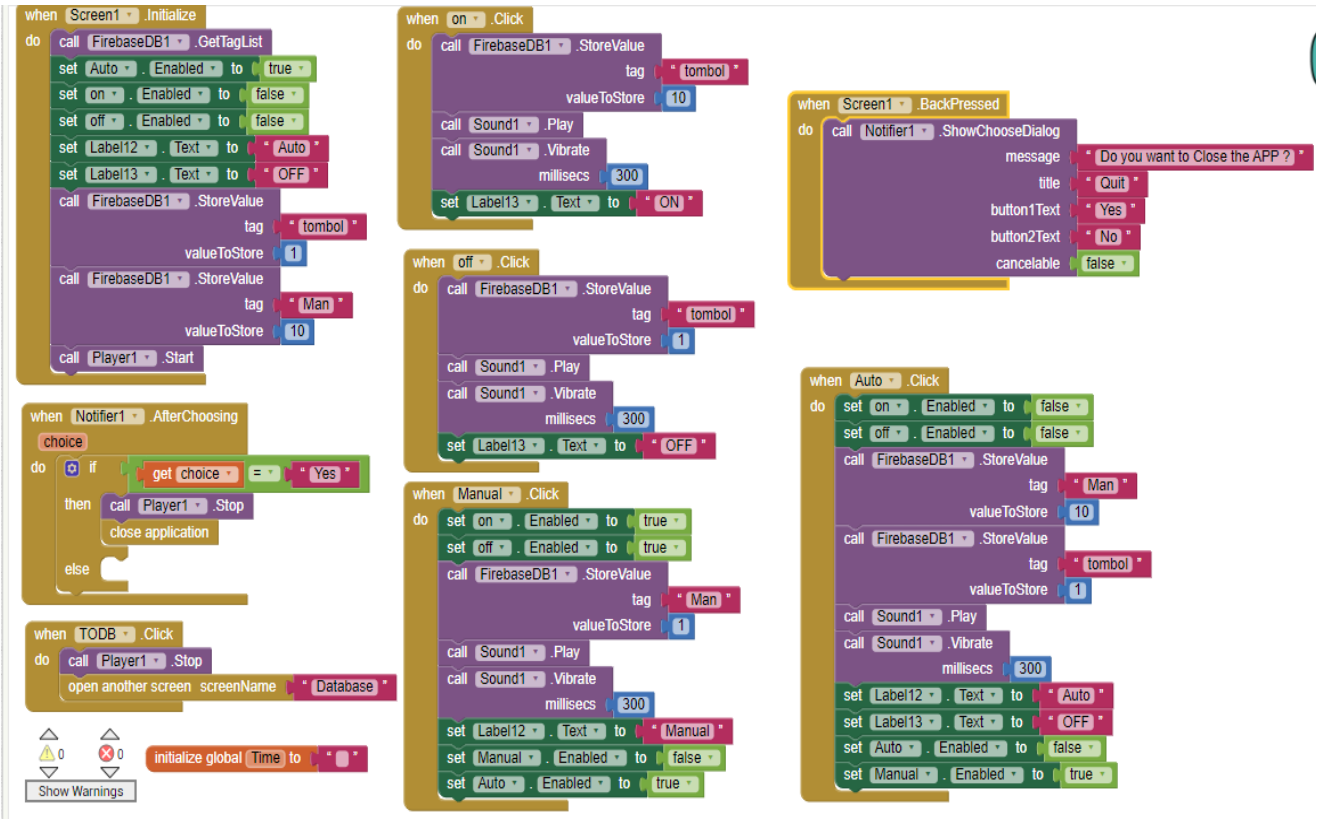

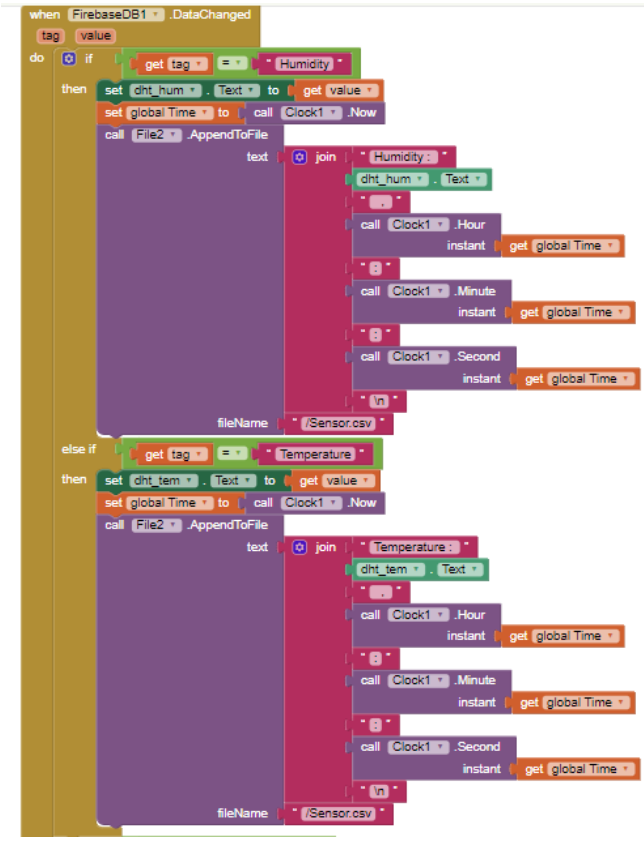

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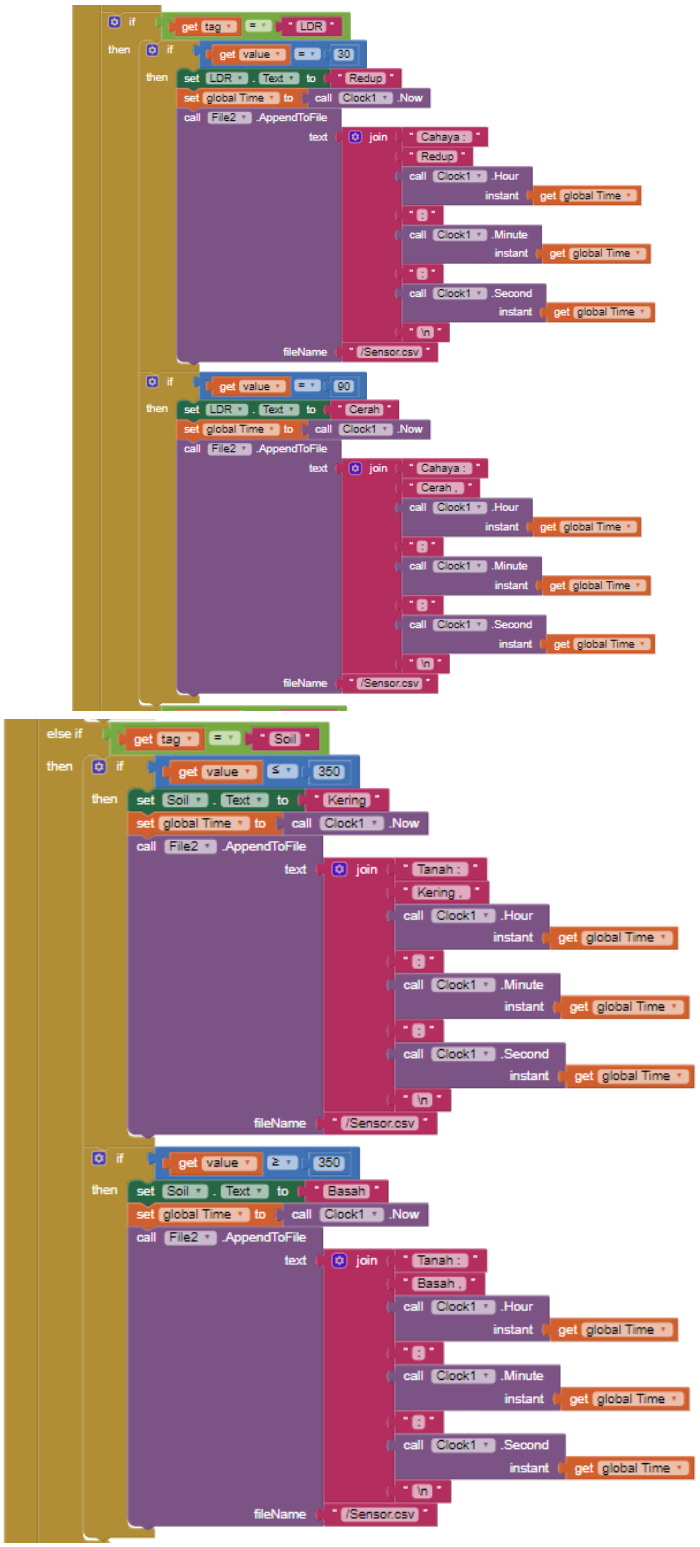

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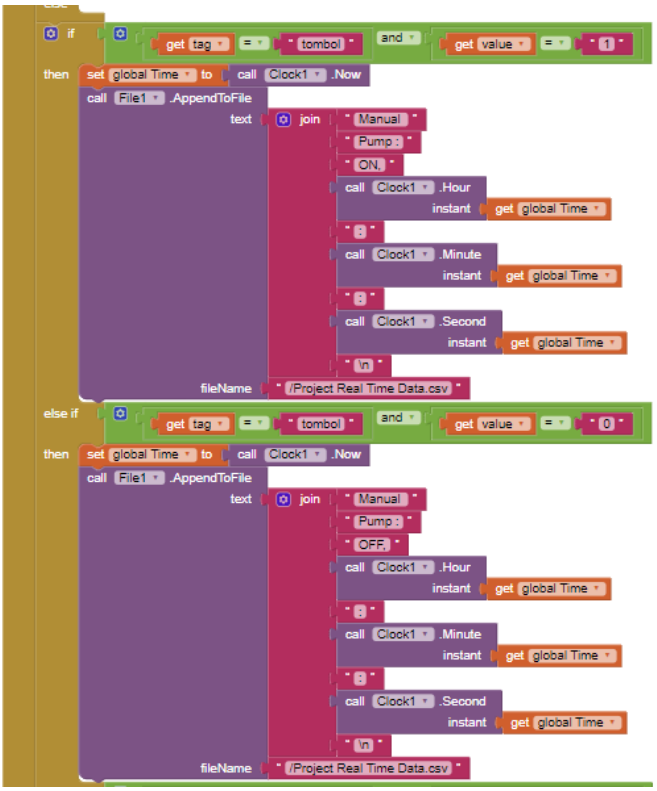

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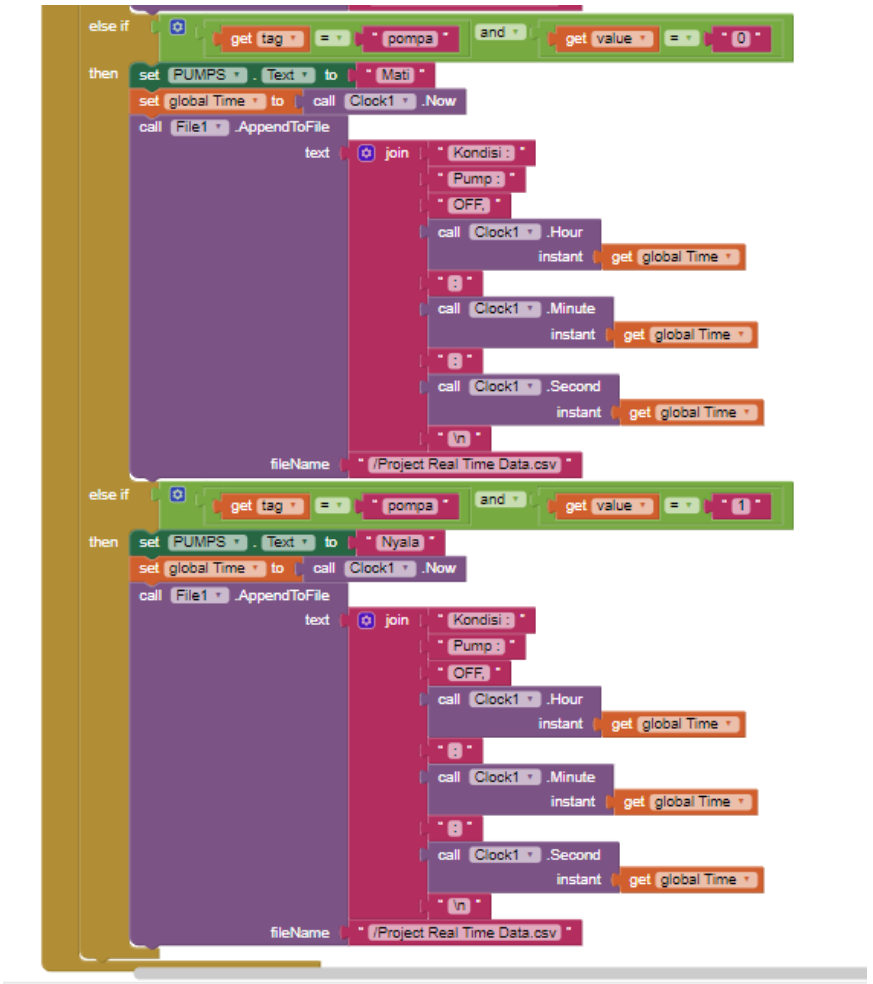

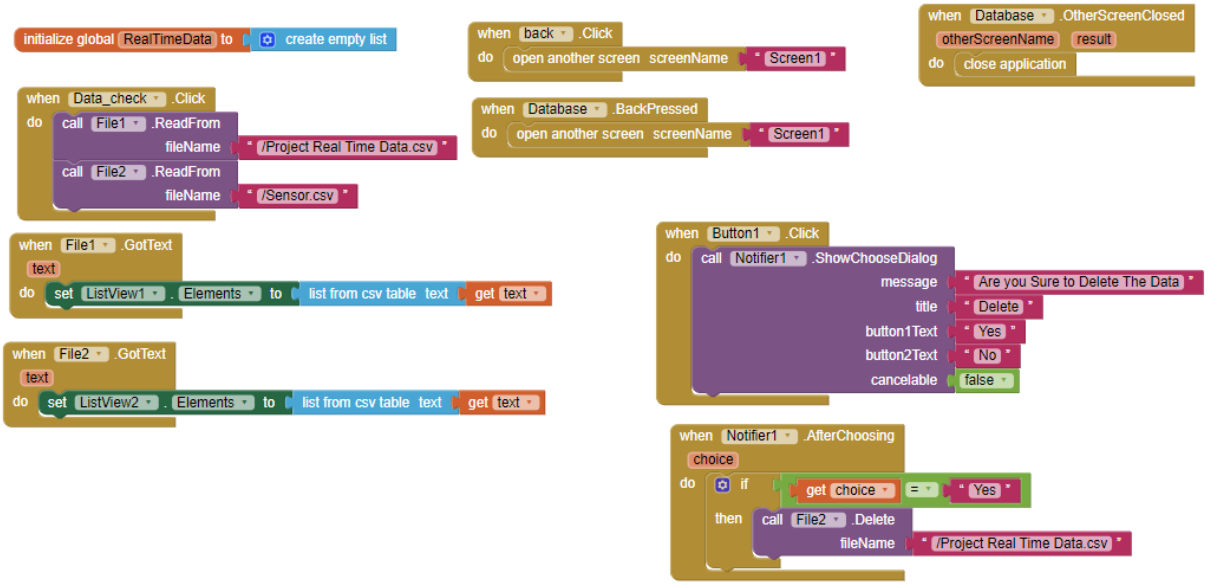

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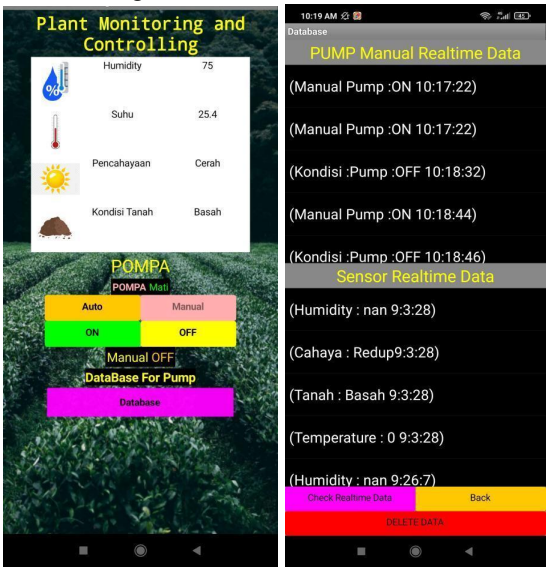
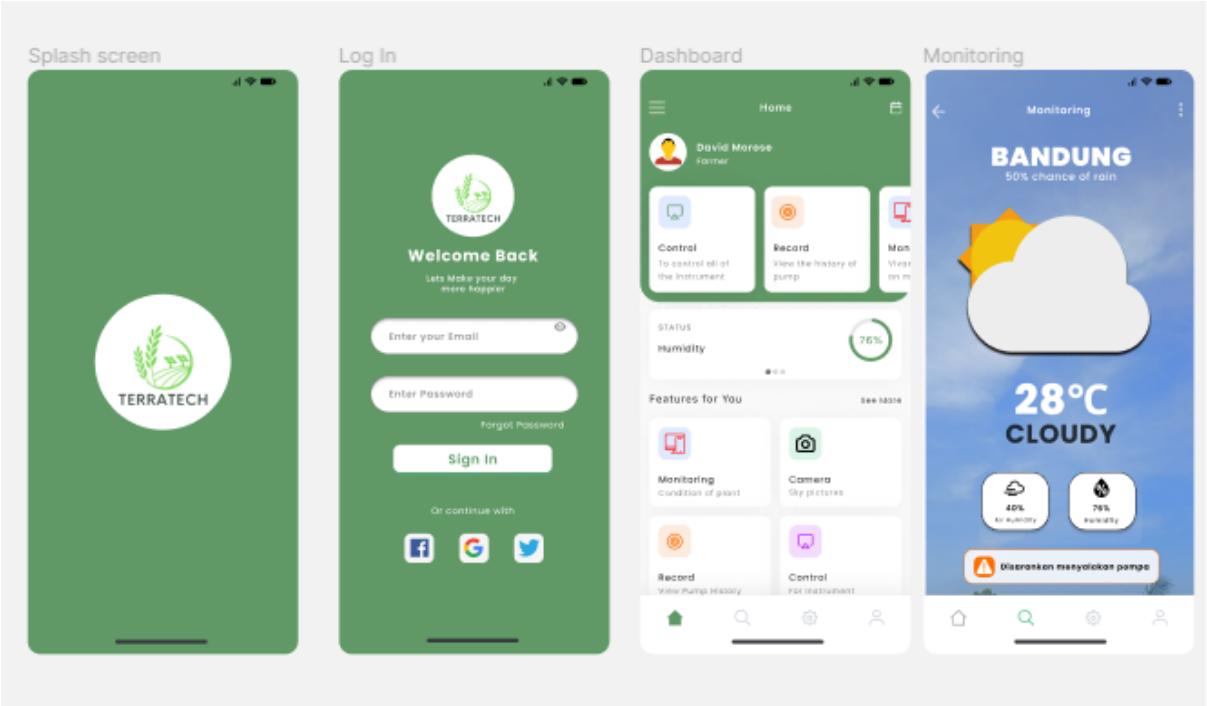
UI/UX Design Terratech





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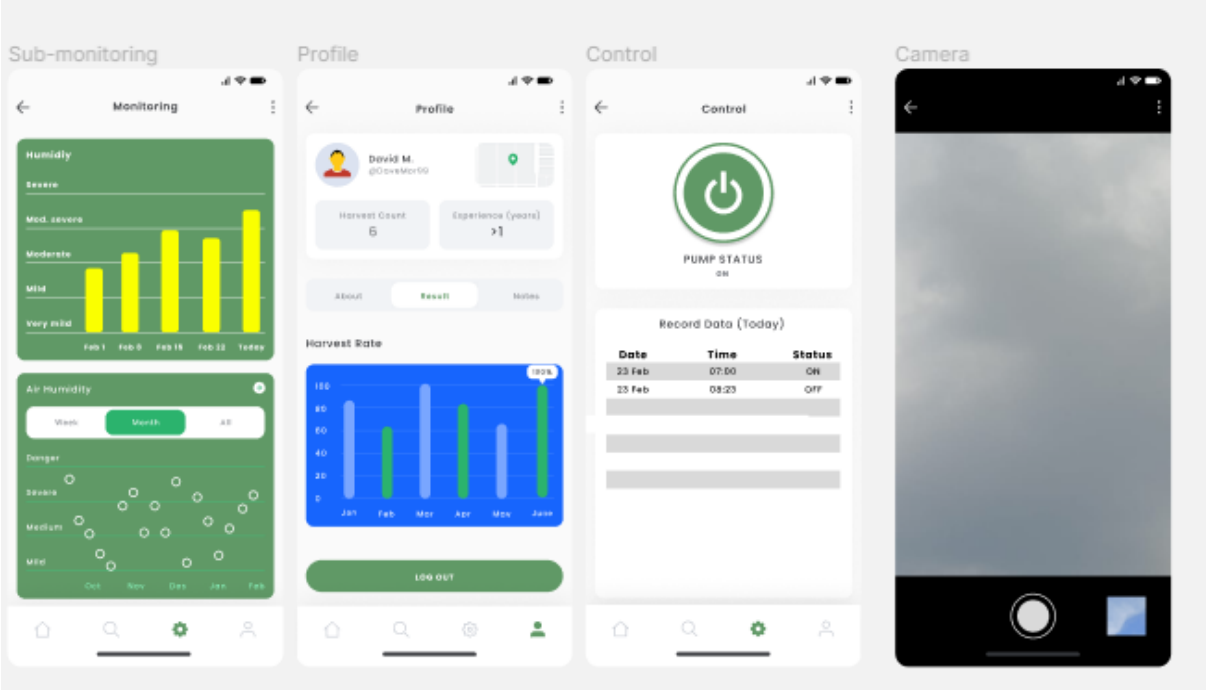

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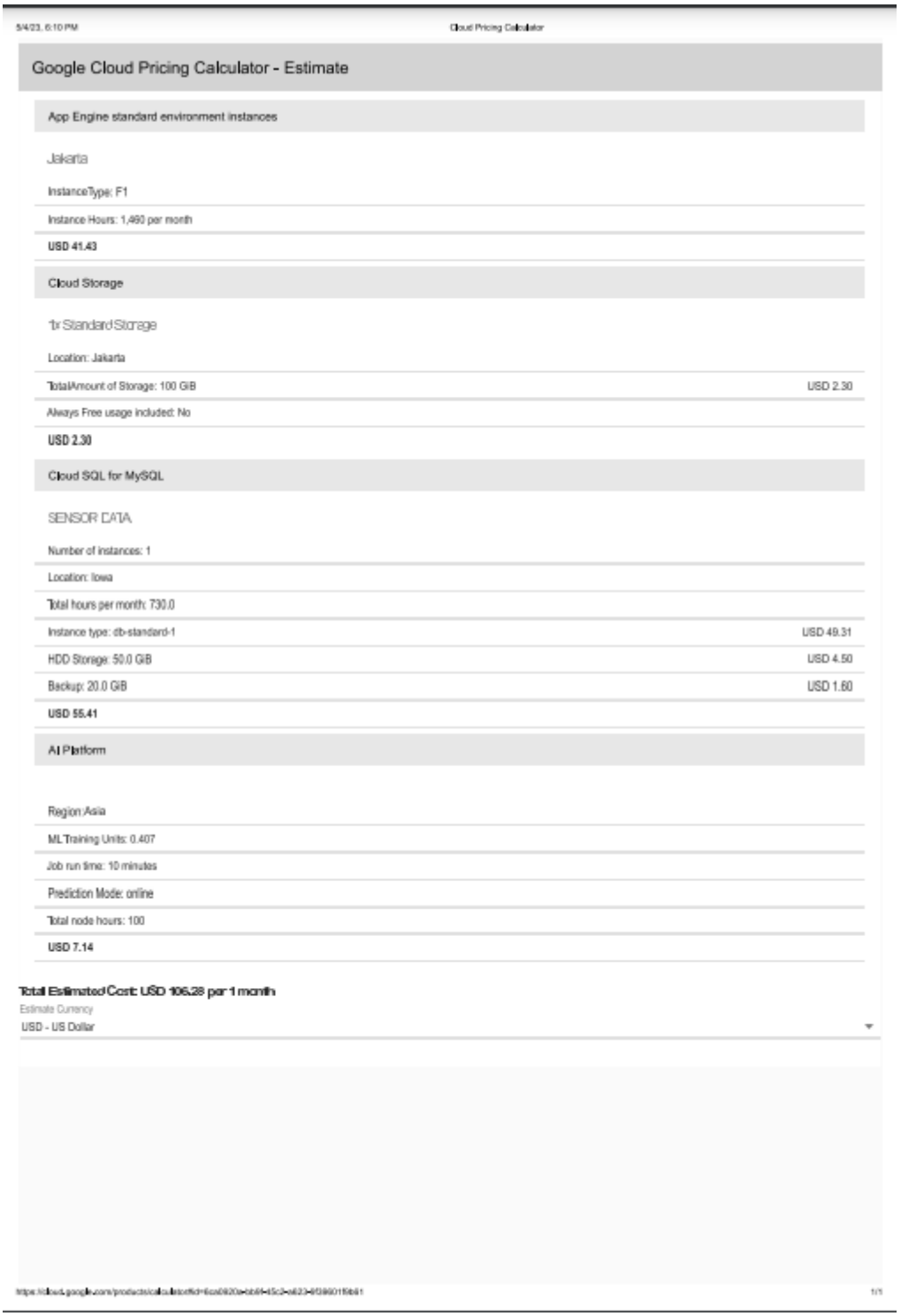

5/4/23, 6:10 PM Cloud Pricing Calculator

Google Cloud Pricing Calculator - Estimate

App Engine standard environment instances

Jakarta

InstanceType: F1

Instance Hours: 1,460 per month

USD 41.43

Cloud Storage

1tr Standard Storage

Location: Jakarta

TotalAmount of Storage: 100 GiB — USD 2.30

Always Free usage included: No

USD 2.30

Cloud SQL for MySQL

SENSOR DATA

Number of instances: 1

Location: Iowa

Total hours per month: 730.0

Instance type: db-standard-1 — USD 49.31

HDD Storage: 50.0 GiB — USD 4.50

Backup: 20.0 GiB — USD 1.60

USD 55.41

AI Platform

Region:Asia

ML Training Units: 0.407

Job run time: 10 minutes

Prediction Mode: online

Total node hours: 100

USD 7.14

Total Estimated Cost: USD 106.28 per 1 month

Estimate Currency

USD - US Dollar

Link for estimate cost:
https://drive.google.com/file/d/1Fc9sSHiScYcvGa8DZYstZOqC6tAI91MC/view?usp=share_link

If we get 10000 dollars and join the incubation, we estimate the following expenditure allocation

Project Plan for Bangkit 2023 Product-based Capstone

NO	Item	Jumlah	satuan	harga satuan	total harga
1	Raspbeeri PI 4 paket	1	buah	Rp 5.140.000	Rp 5.140.000
2	webcam logitech insta 360 link	1	buah	Rp 5.300.000	Rp 5.300.000
3	soil moisture sensor	3	buah	Rp 87.000	Rp 261.000
4	dht 22	3	buah	Rp 62.000	Rp 186.000
5	relay dc 5v - channel	3	buah	Rp 10.000	Rp 30.000
7	app engine standart environment instances	1	bulan	Rp 616.000	Rp 616.000
8	cloud storage	1	bulan	Rp 33.000	Rp 33.000
9	cloud sql for mysql	1	bulan	Rp 821.500	Rp 821.500
10	ai platform	1	tahun	Rp 110.000	Rp 110.000
11	legal, haki, cv	1	tahun	Rp 12.500.000	Rp 12.500.000
12	panel control pompa	1	buah	Rp 1.085.000	Rp 1.085.000
13	biaya pemasangan	1	buah	Rp 12.000.000	Rp 12.000.000
14	domain web	1	tahun	Rp 264.000	Rp 264.000
15	pompa	1	buah	Rp 1.920.000	Rp 1.920.000
16	paket solar panel	1	buah	Rp 50.000.000	Rp 50.000.000
	TOTAL				Rp 90.266.500

nuat businesssize