The AquaTally Project
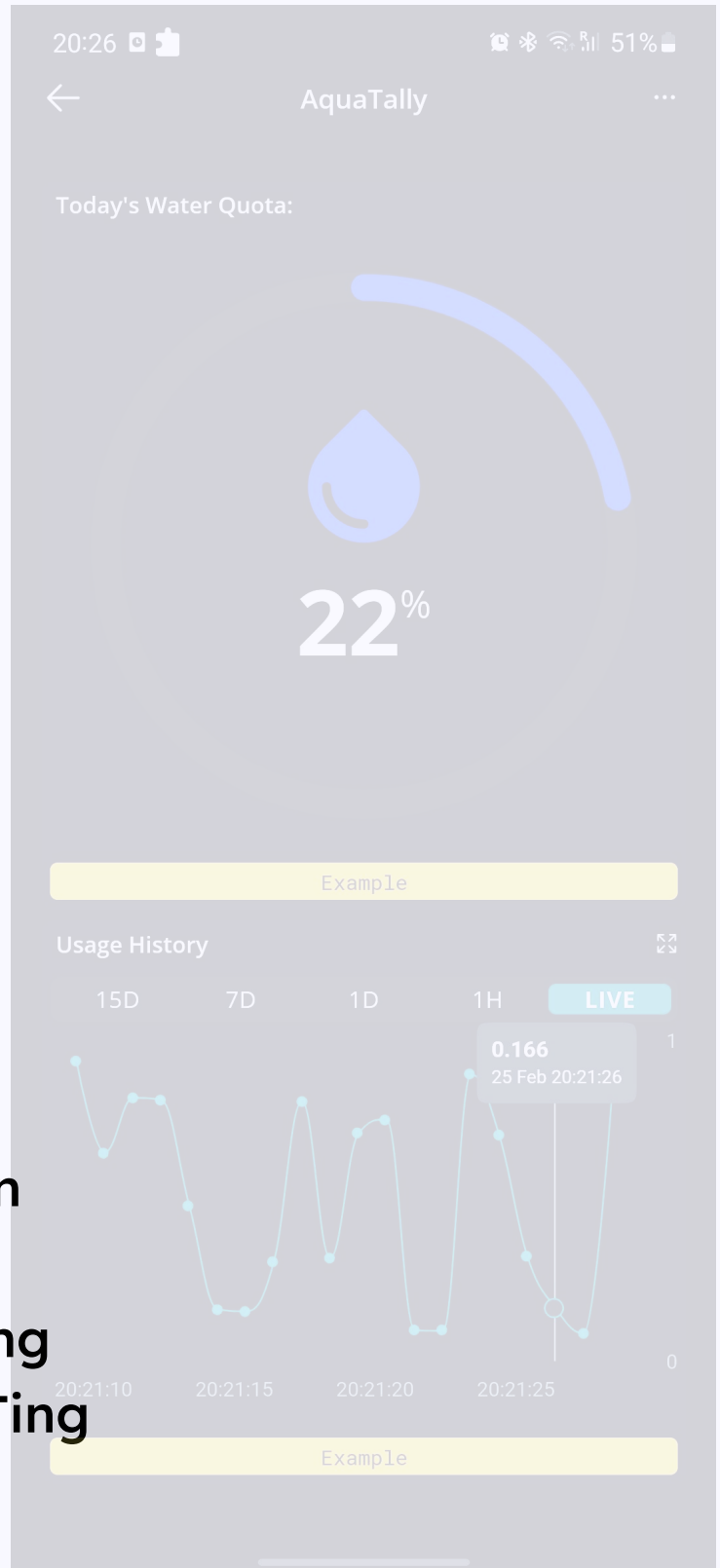
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1. THE BIG IDEA

1. Project Background and Context:

The AquaTally project aims to address the pressing issue of water wastage and promote water conservation awareness, particularly in areas prone to water scarcity. Each device uses a hydro turbine and Arduino Nano to monitor tap water usage. When a preset limit is reached, it triggers a buzzer alerting users to conserve water. The project aims to change how people view the water they use and raise awareness about water wastage.

Project Location:

Our project will be carried out in Pulau Langkawi, an archipelago known for its stunning natural beauty and vibrant tourism industry. Langkawi faces water scarcity issues exacerbated by its tropical climate and high tourist influx.

Main Beneficiary:

The main beneficiary of the AquaTally project is the local community of Pulau Langkawi and its environment.

Problem Statement:

Pulau Langkawi experiences water scarcity, exacerbated by rapid development and wasteful practices such as uncontrolled water usage in hotels, households, and public facilities. This not only strains local water resources but also threatens the ecosystem and impacts the island's tourism-dependent economy. Alternative sources of water like rainwater collection and groundwater harvesting are not feasible due to being more expensive and less reliable than the regular supply of water. Thus, the residents of the island are left with a choice: either spend more and more effort importing water from another state, or use the water that they have more carefully.

2. PROJECT OBJECTIVES

Vision Statement:

Our vision is to mitigate unnecessary water consumption on Pulau Langkawi by raising awareness and leaving a legacy of sustainable water management practices.

Clearly Defined and Measurable Goals:

Short term (March-April):	Long term (Next 2 years):
- Build around **10 modules** of AquaTally with the budget allocated, half will be allotted towards hotels to tackle the tourism industry, while the other half will be allotted to schools and residents to leave a lasting impact for the future generations - Install AquaTally devices in selected hotel rooms and public areas, on the faucets of a chosen school facility, and for volunteering local residents over the course of **a week** - Save unnecessary water usage by **10%** on average over the course of 3 weeks, compared to the usual amount - Create a user manual for maintenance purposes	- Lower cost of each module by 10% by manufacturing custom circuit boards, turbines and and emitters which are cheaper and lighter to produce to replace the Arduino Nano board we are currently using - In an effort to be economically self-sustaining, sell each AquaTally module at twice the price of production (*see Page 3*). **For each module sold to businesses, one module will be donated to public facilities and local residents** - Install AquaTally devices in more hotels and public facilities (public toilets, parks, schools) on the island, to create **more publicity** towards our movement - Raise awareness about water conservation among locals and tourists through educational campaigns and outreach programs organized twice a year

3. PROJECT APPROACH AND METHODS

Solution Description:

The AquaTally device integrates a hydro turbine connected to an Arduino Nano, which is installed on taps, faucets or shower heads to monitor water usage. When water flows through the tap, the hydro turbine generates power to activate the Arduino Nano. Once a predetermined threshold of water usage is reached, the Arduino Nano triggers a buzzer to alert users to turn off the tap, thus minimizing water wastage. This also subconsciously trains the user to always be aware when they turn on a faucet, even when the user is using a faucet that does not have AquaTally installed to it.
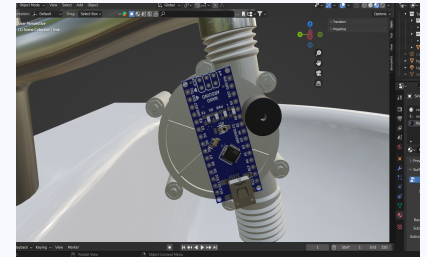
3D model of AquaTally module

Incorporating Digital Technology:

The Arduino Nano serves as the digital interface to monitor water flow and trigger alerts. The **mobile application** will then collect data from the devices to be analyzed in order to identify patterns of water usage and optimize conservation efforts. The mobile application serves to gamify the process of building good water saving habits, by keeping track of all the water used by the user, and congratulating them when they manage to find ways to significantly reduce water wastage in their daily lives.

Another digital technology we plan on incorporating is an **online campaign** to raise awareness of wasteful habits and address the root cause of water wastage in Pulau Langkawi.

These solutions and technologies are able to further our vision of leaving a lasting impact on sustainable water management practices.
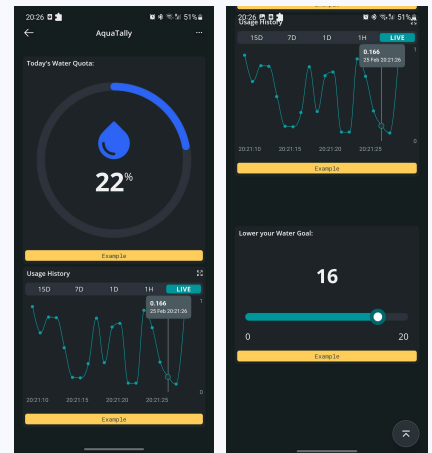
AquaTally Mobile Application

4. PROJECT IMPACTS

- Significant reduction in water wastage (10% - 20%), leading to more sustainable water management practices.
- Increased awareness about water conservation among locals, tourists, and businesses through online campaigns.
- Positive environmental impacts, including preservation of local ecosystems and biodiversity.
- Economic benefits through cost savings for businesses and enhanced reputation for sustainable practices.
- Eventually, leave behind a community that is mindful of, and reminds each other of how precious water is on Pulau Langkawi, to preserve water wherever they can, even when AquaTally eventually phases out of the market.

2. THE PILOT

1. The Pilot Project:

The pilot project entails a small-scale implementation of AquaTally's solution within Pulau Langkawi over a span of 6 weeks, to validate the effectiveness of the AquaTally device in conserving water by notifying users about excessive water usage.

- **Scope**: The pilot project will focus on installing AquaTally devices in schools and local communities across Pulau Langkawi, as well as distributing devices to selected hotels (10 outlets in total).
- **Objectives**:
  1. Assess the functionality and reliability of the AquaTally device in real-world settings.
  2. Evaluate user acceptance and satisfaction with the device.
  3. Measure water conservation outcomes achieved through the use of AquaTally.
  4. Identify any technical issues or improvements needed for the device.

2. Pilot Project Timeline:

ID	TASK TITLE	PHASE ONE — WEEK 1					WEEK 2					PHASE TWO — WEEK 3					WEEK 4					WEEK 5					PHASE THREE — WEEK 6				
		M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
1	**Preparations**																														
1.1	Confirm locations of participating hotels, schools and local communities	█																													
1.1.1	Review the tap, sink and faucet types of all locations to prepare faucet adapters	█	█	█	█	█																									
2	**Set Up**																														
2.1	Arrive at Langkawi to set up AquaTally modules and mobile app on site						█																								
2.2	Perform a control test without any alerters to estimate normal water usage						█	█	█	█																					
3	**Project Launch and Execution**																														
3.1	Collect data on amount of water used with alerters and app turned on											█	█	█	█	█	█	█	█	█	█	█	█	█	█	█					
3.2	Observe the installed modules for any unforseen issues											█	█	█	█	█	█	█	█	█	█	█	█	█	█	█					
3.3	Collect user feedback											█	█	█	█	█	█	█	█	█	█	█	█	█	█	█					
4	**Campaign**																														
4.1	Host online campaigns and talks with the data we collected																										█	█	█		
4.2	Start introducing AquaTally to the broader local community																										█	█	█		
5	**Revision**																														
5.1	Review the data collected and innovate on our current prototype																													█	
5.2	Prepare a report on the findings and outcomes of the pilot project																														█

Higher Quality: https://drive.google.com/file/d/1JISrzz0A4TgDZnn3yXgOy4I-Orr1PmGy/view?usp=sharing

3. Stakeholder Mapping:

- **Hotels**: Engage with hotel management for device installation and feedback collection.
- **Schools**: Collaborate with school authorities to distribute devices and gather student feedback.
- **Local Communities**: Work closely with selected resident members to distribute devices and gather community feedback.

4. Budget Plan:

- Site Visit and Engagement: RM 2000 ($418.63)
- Cost to Build and Implement: RM 53.98 ($11.29) per module, RM 539.80 ($112.90) for 10 modules

Description	Price	Source
WZINTOP 10W Hydro Turbine	RM 28.51	https://shopee.com.my/10W-Water-Flow-Pump-Mini-Hydro-Generator-Turbine-Flow-Hydraulic-Conversion-12V-i.115726221.2471953293
Arduino Nano Microcontroller Board	RM 16.99	https://shopee.com.my/NANO-V3-(CH340)-Microcontroller-ATmega328-Development-Board-Arduino-Compatible-MINI-Type-C-i.126211897.6363280546?sp_atk=a5193bde-6cc9-4a47-870d-c618cd4a2a6c&xptdk=a5193bde-6cc9-4a47-870d-c618cd4a2a6c
Active Piezoelectric Buzzer	RM 2.40	https://shopee.com.my/DC3-24V-SFM-20B-Active-Piezoelectric-Buzzer-Long-Continous-Beep-Tone-Buzzer-i.33091591.2235300595?sp_atk=eab7fe4d-df93-4299-823c-c0134a233b21&xptdk=eab7fe4d-df93-4299-823c-c0134a233b21
Bathroom Tap Aerator Connector	RM 5.08	https://shopee.com.my/SUYOU-Bathroom-Tap-Aerator-Connector-With-washer-Kitchen-Faucet-Outside-Thread-Useful-Metal-Water-Purifier-Accessories-Aerator-Adapter-Water-Saving-Adaptor-i.70512214.6659287378?sp_atk=ffb22972-26f0-45e8-ae86-245977e2bd68&xptdk=ffb22972-26f0-45e8-ae86-245977e2bd68
Total (per module)	RM 53.98	Total Budget: RM 2539.80 ($531.52).

-The maximum cost is within the allocated seed money of $1,000, ensuring efficient utilization of resources for the successful execution of the pilot project. Any additional costs, if incurred during production that exceeds the provided grant, will be allotted from the Site Visit and Engagement funds. Any additional costs incurred during on-site visits exceeding the seed grant will be funded by the team.