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Concept Paper: Long-Range Data Transmission for Online Water Quality Monitoring at Rural Area in Sg. Tembeling, Pahang

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1. Introduction

The Location - Malaysia

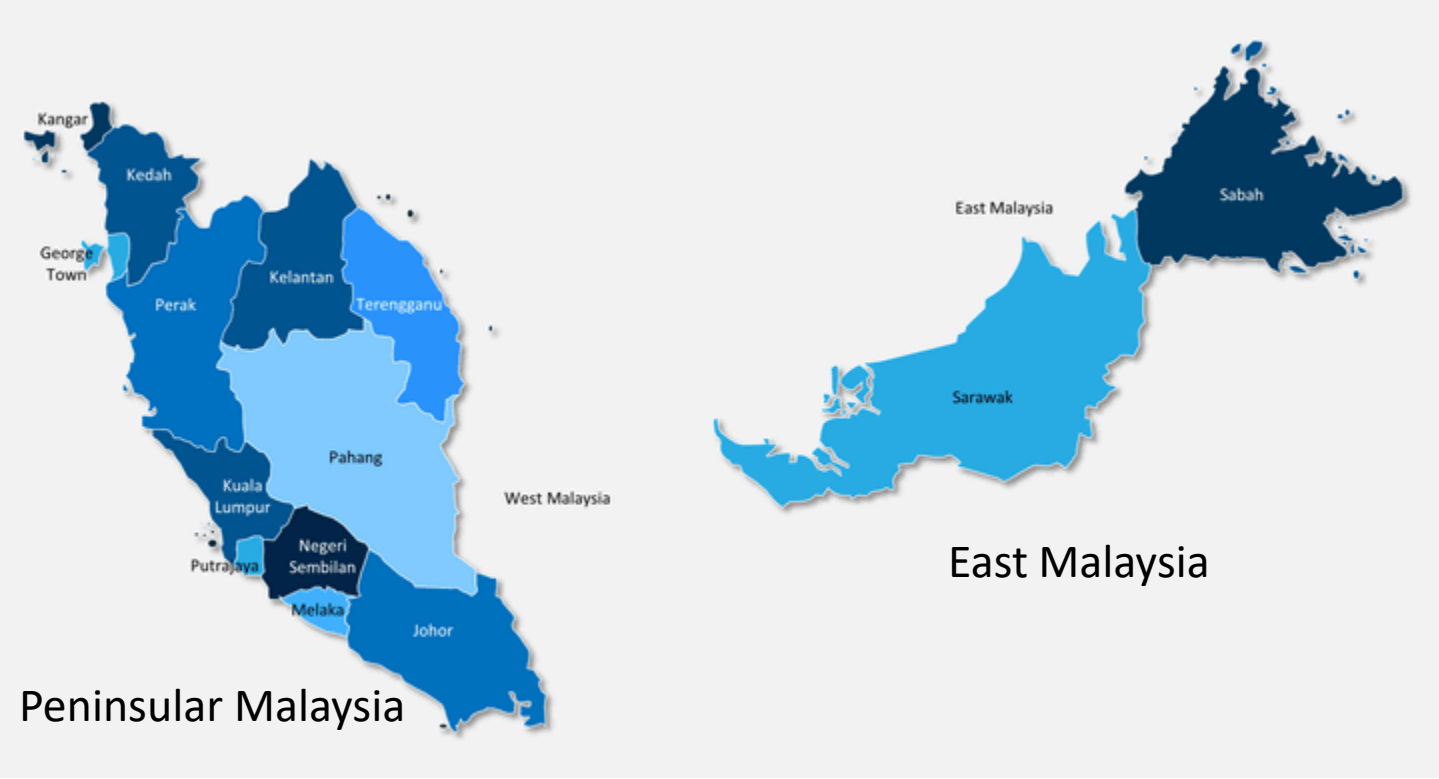

Figure 1 Map of Malaysia

1. Introduction

The Location – Pahang, Malaysia

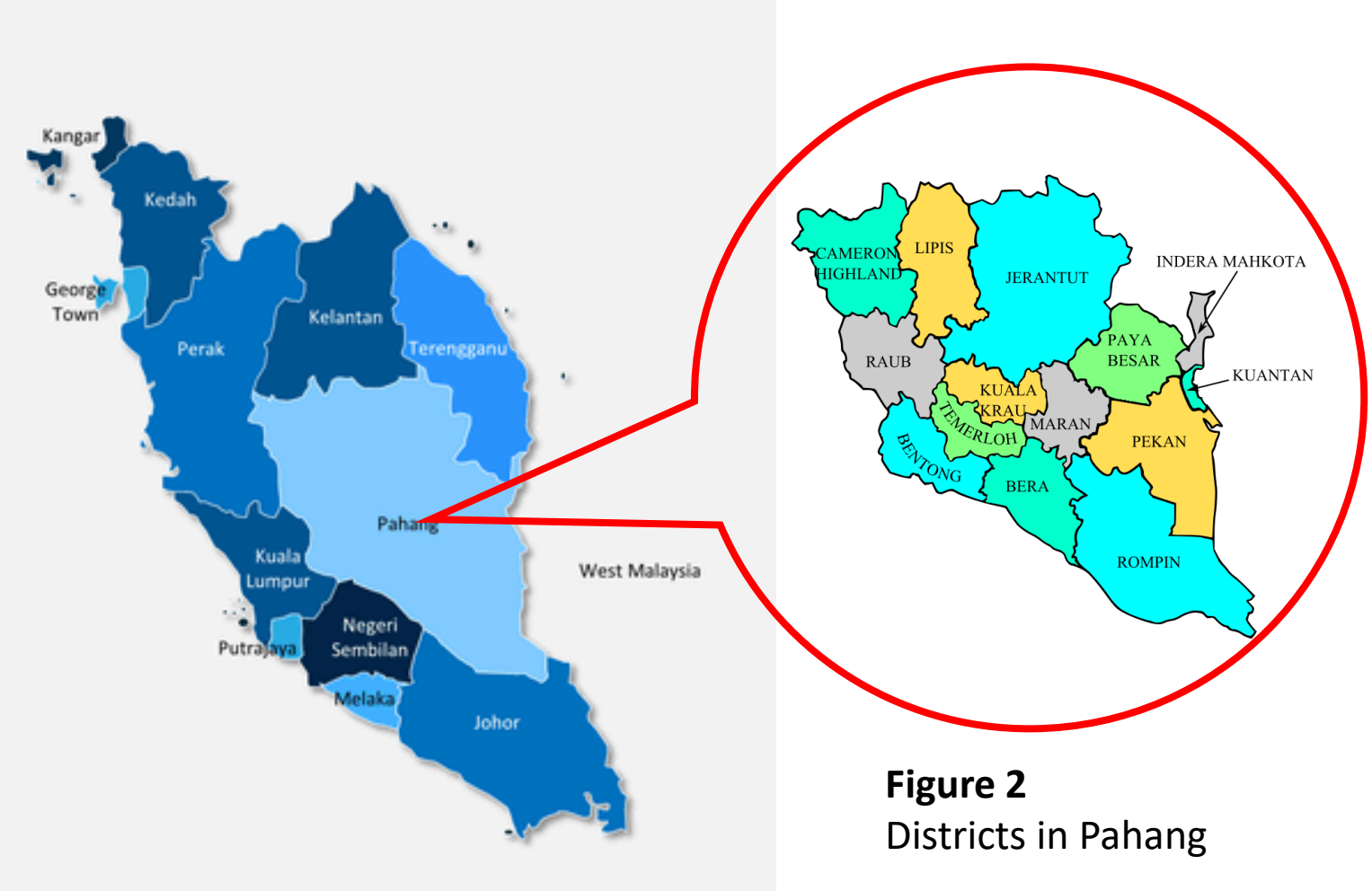

Figure 2
Districts in Pahang

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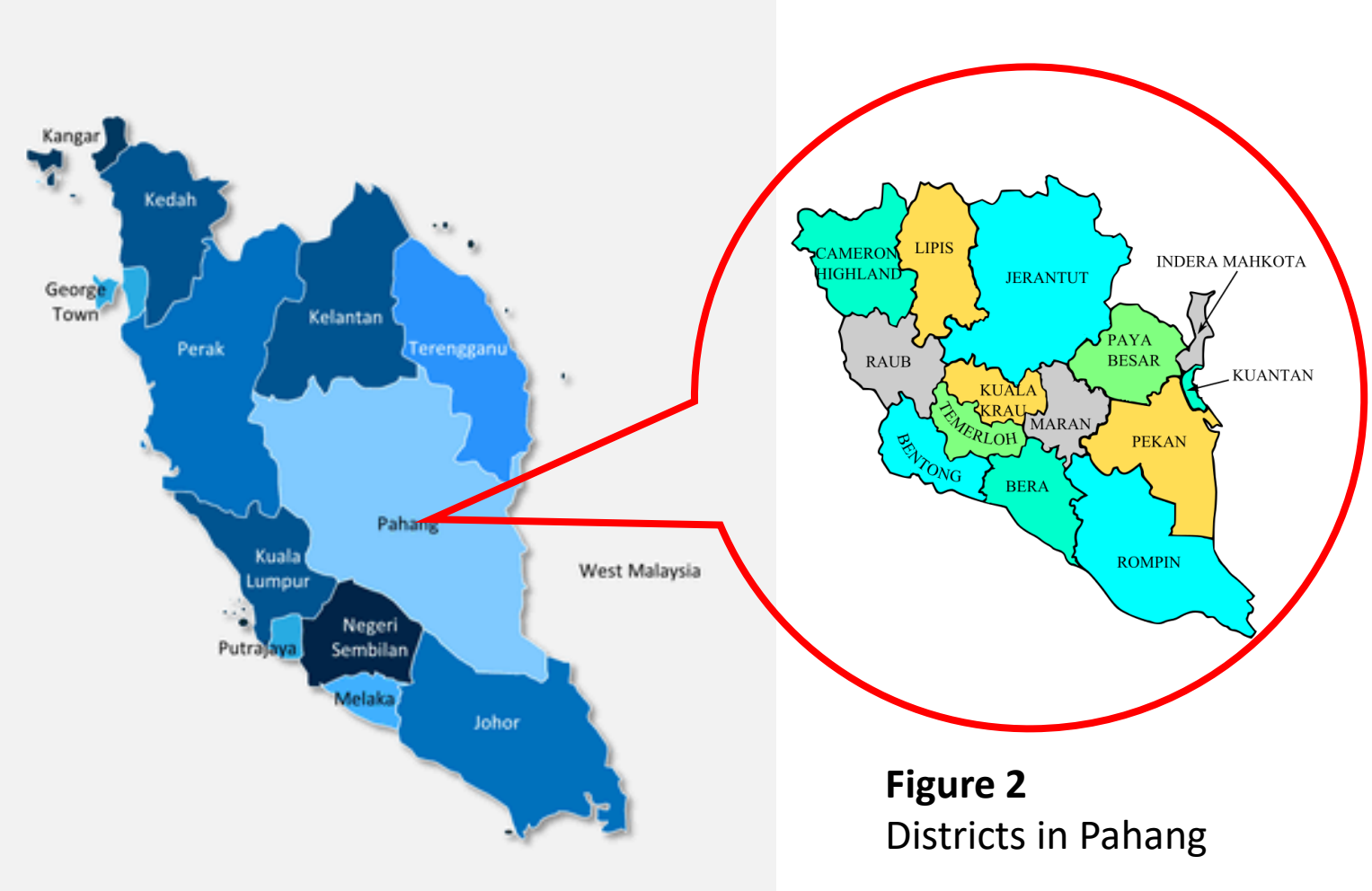

Figure 2
Districts in Pahang

- 3rd largest Malaysian state
- It has 11 administrative divisions called *daerah* (districts)
- Pahang occupies the vast Pahang River basin
- 2/3 of the state is a dense jungle including of 74 forest reserves (10 virgin jungle reserves and 13 amenity forests), wildlife reserves, parks and several marine parks.
- The most popular reserved rainforest is Taman Negara Pahang (Pahang National Park).

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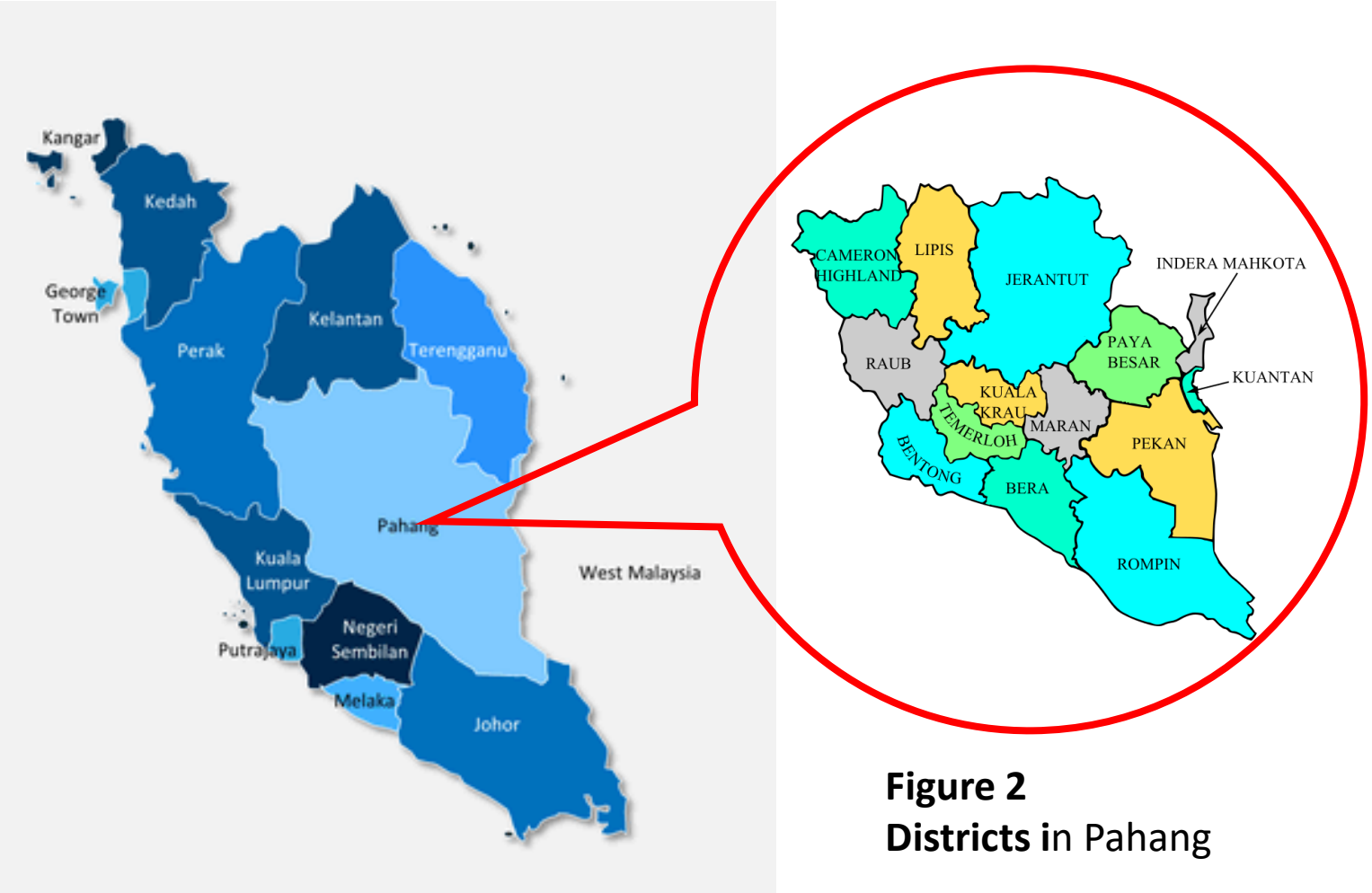

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Figure 3
Pahang National Park

a. Tembeling River, Pahang.

Tembeling River is the main tributary of the Pahang River and well-known among local and international tourists as regard to eco-tourism activities.

The community still utilizes the Tembeling River as a source of clean water and food.

Places such as the village of Mat Daling (Kampung Mat Daling), Pagi village (Kampung Pagi), Bantal village (Kampung Bantal), and Kuala Sat village (Kampung Kuala Sat) still rely on boats as a means of transport by using the commercial boat.

A small number of locals perform aquaculture activities on the Tembeling River, where species such as patin (Pangasius sutchi) and tilapia are bred [7] for commercial.

Figure 4
Boat activities at Tembeling River

Figure 5
Aquaculture activities at Tembeling River

b. Current Situation at Tembeling River

1. Extensive anthropogenic activities causing river pollution.
2. Extreme flood events caused contamination of the rivers and surrounding environments.
3. The problems of the cleanliness of the river, unforeseeable climate change, and the loss of fish and shrimp, have influenced their daily lives and income [13].
4. A continuous water monitoring system at Sungai Tembeling, Pahang to monitor the impact of ecological and anthropogenic activities on fishing activities is therefore important for the future improvement and development of fisheries.

Figure 6 Tembeling River nearby the entrance of the National Park

Figure 7 Extreme flood event at Tembeling River in 2015

Figure 8 Tembeling River drying up during heatwave

c. Research Area – Kampung Pagi, Tembeling River, Pahang.

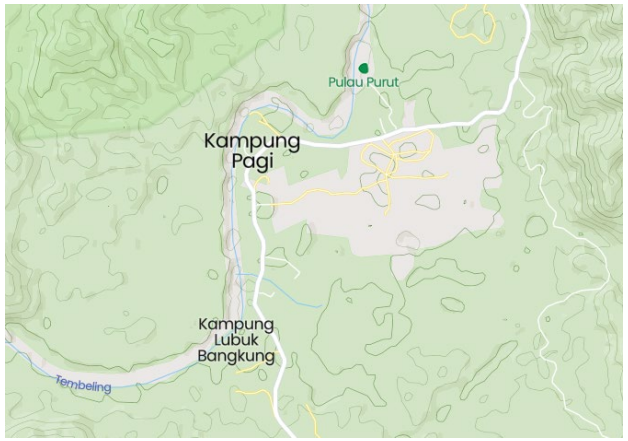


Figure 9 Kampung Pagi is located at Tembeling River

Figure 10 Kampung Pagi, Pahang from Aerial View

Figure 11 Primary School at Kampung Pagi, Pahang.

Kampung Pagi is one of the residential area nearby Sungai Tembeling, Pahang. It always become the tourist hotspot when come to Pahang National Park. This even terrain of Kampung Pagi is suitable to implement the proposed long-range data transmission for water quality monitoring system at Tembeling River.

2. Problem Statement

To implement a continuous water monitoring system at Kampung Pagi, Tembeling River, there are few associated problems have been identified. The problems are:-

The network

1. The tele centers built by the Malaysian Govenrment in Pahang are far from the research area at Kampung Pagi, Tembeling River and challenging to access.
2. Beyond the challenges of 2G connectivity, another problematic element of wireless data transmission in the remote monitoring site caused by the uneven terrain that creates limited coverage. It will result in a non-Line-of-Sight (NLOS) link between the transmitter and the receiver.

3. The Objective

To address the problem of limited access on mobile signal coverage (GSM, WCDMA, LTE, and 4G) at the Tembeling River remote site, we proposed a procedure for wireless data transmission between the water sensor nodes and the base station by using the repeater technique. This technique is implemented a long-range data transmission.

Figure 12 The proposed research area

4. The Proposed: Long-range Data Transmission Protocol – A Concept

The long-range data transmission consists of 3 modules.

a. Sensor Node

- Collect water parameters.
- Each of the data from the sensors is collected and appended to an array.
- The array is conveyed to the data extender module system from the sensor node.
- Each array packet has an identifier header to identify the node.

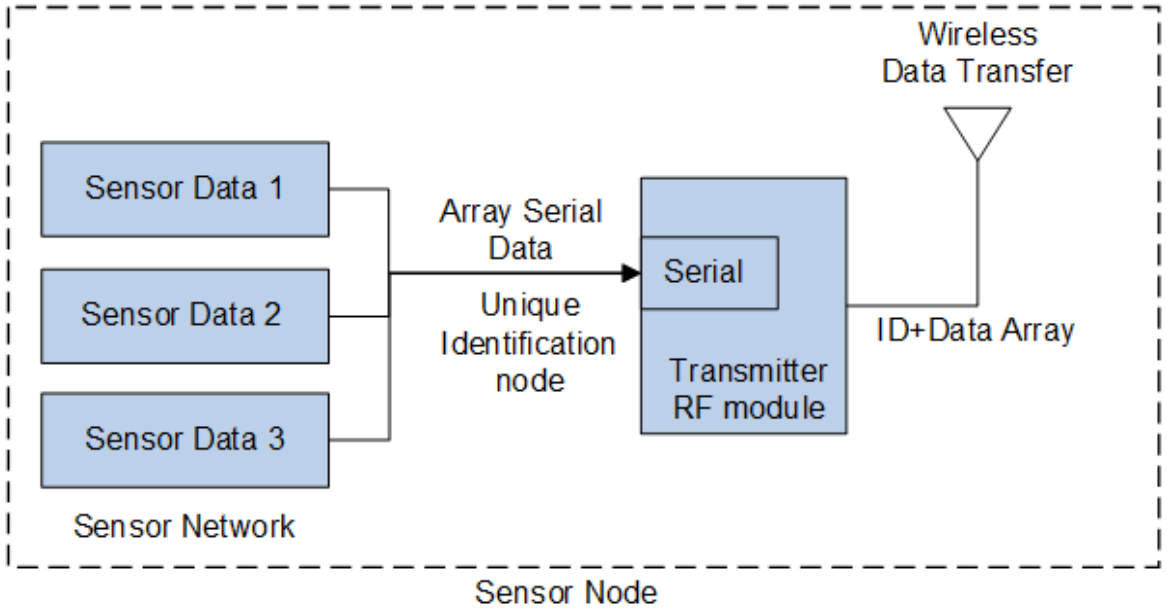
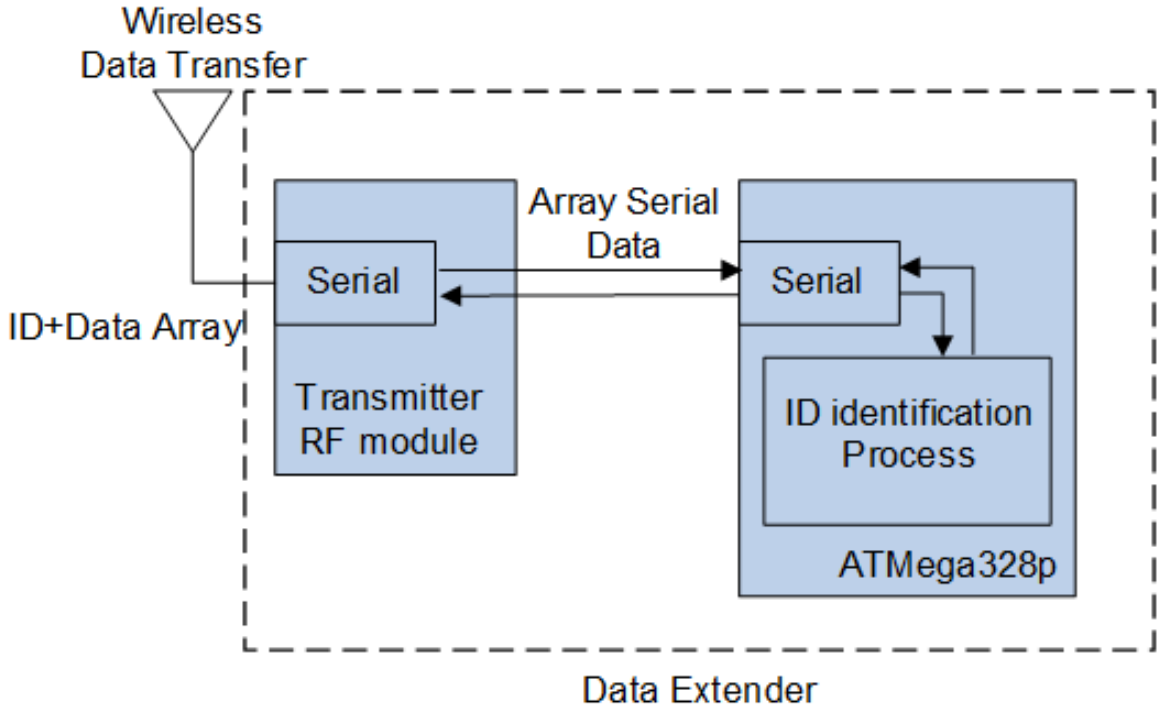


Figure 13 The sensor node to collect water parameters.

b. Data Extender

- Also known as Data Repeater.
- The communication line will be built to find the best place for LOS communication to ensure the reliability in data transmission.



1. **Figure 14** The designed data extender module system.

c. Base Station

- collects all the data transmitted by the extender modules.
- The received data is filtered and identified based on the unique identification appended in the data array.
- Then the controller processes the data array by separating it into individual water parameters.
- The water parameters will later be published on the cloud.

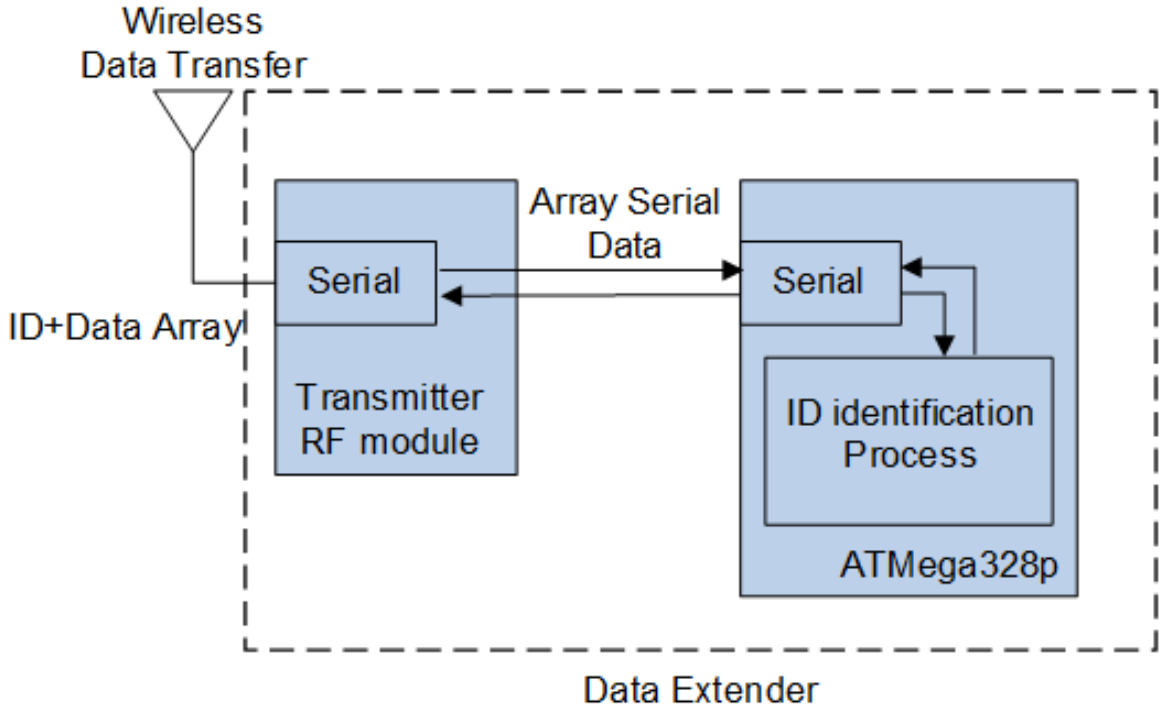


Figure 15 The base station module to transmit the received data onto IoT Cloud platform for online water quality monitoring system.

5. Conclusion

- Tembeling River is vital for the provision of fish habitat, which becomes the primary income for the nearby community.
- Unfortunately, the monsoon season, floods, anthropogenic activities, nearby plantation activities and boat navigation have impaired the water quality at this river, which reduces the species of the fish and their occurrence in the river which affect community income.
- The online remote monitoring system has to be fitted with wireless data transmission for a long-range application to make it visible online.
- Due to uneven terrain and limited communication coverage, the data transmitted from the remote sensor node module must be expanded through the use of the network of repeaters via the RF long-range transmission line.
- The position of these repeaters could be determined by observing the intensity of the RSS signal at each node, as it applies the LOS communication media. When the data reaches the base station, it is transmitted to the cloud system to be displayed on the online IoT dashboard.

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Thank
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