



# Development of Long Range Remote Control



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## Introduction

- ❖ LoRa network is becoming as one of the most important Low Power Wide Area networks, since it enables low-energy devices. This project aims communication wide area with LoRa modules for IoT applications. Firstly, several typical application scenarios of LoRa network are discussed. Then decide which LoRa module will be used and system is designed as user-friendly.
- ❖ The aim of the project was to provide wide area communication using low energy using LoRa modulation.

## Application Areas

- ❖ With the IoT paradigm presenting itself as the future of the internet, LoRaWAN cannot be overlooked as a fundamental part of IoT. As we now know, it presents itself as the network that will be used for almost everything.
- ❖ Smart farmings, Smart cities, Smart Healthcare etc.



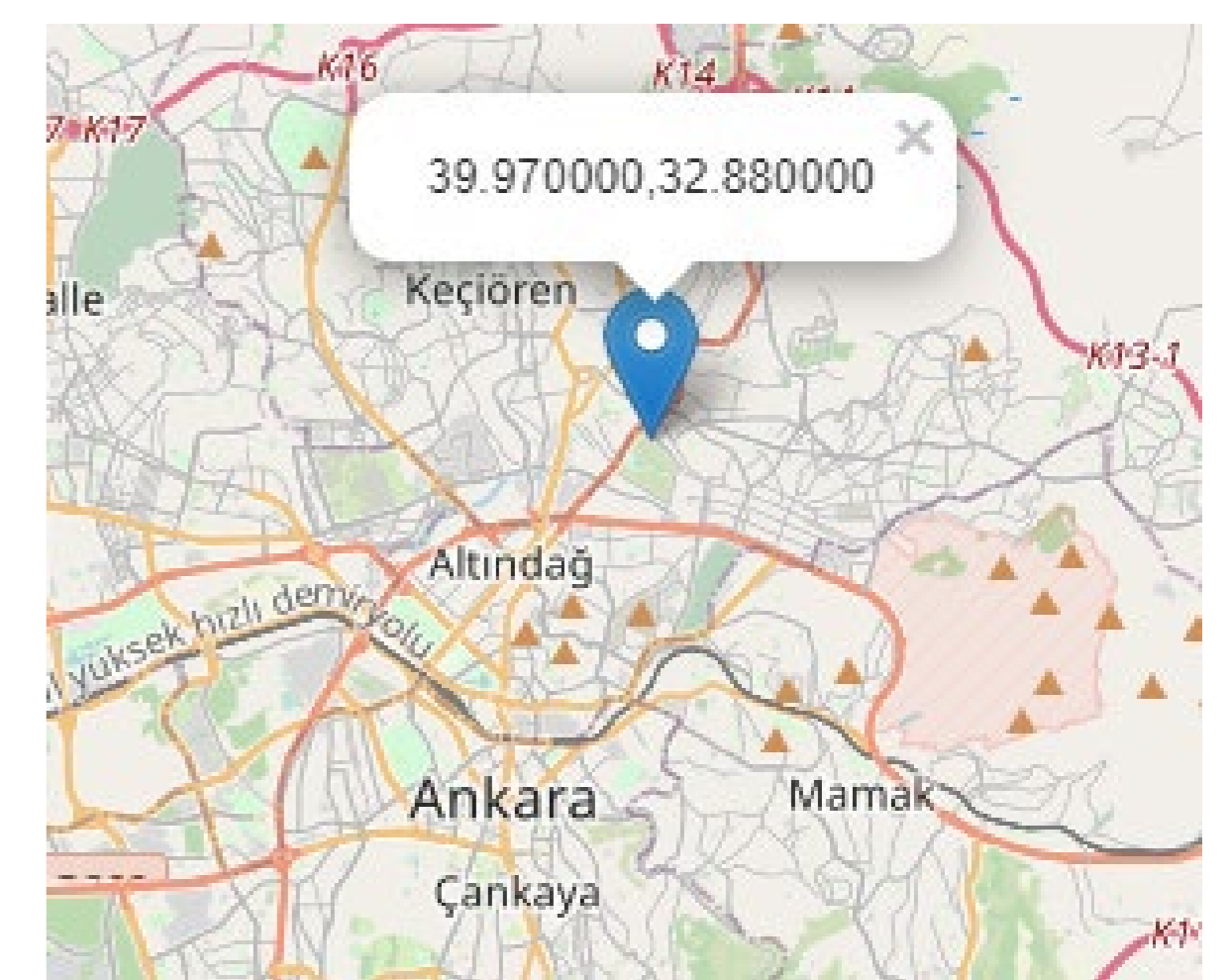
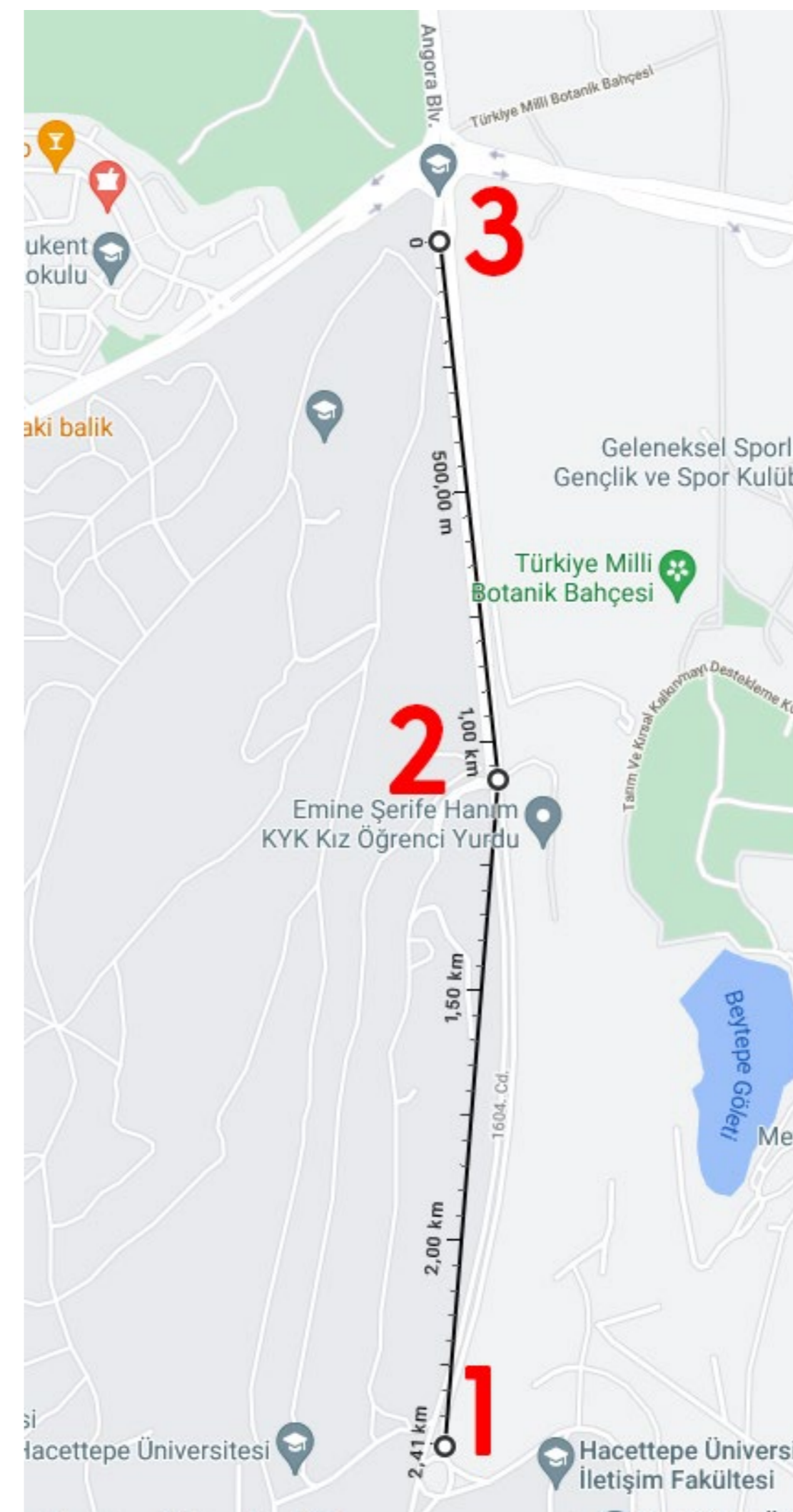
## Specifications and Design Requirements

- ❖ The first subsystem functions as a command and control center. The user can request both GPS and DHT11 sensor data from the 3rd system, which is 3-4 km away. Second subsystem is here to transfer the information. The main system, which works in a kind of mesh network structure, can receive the information after request.



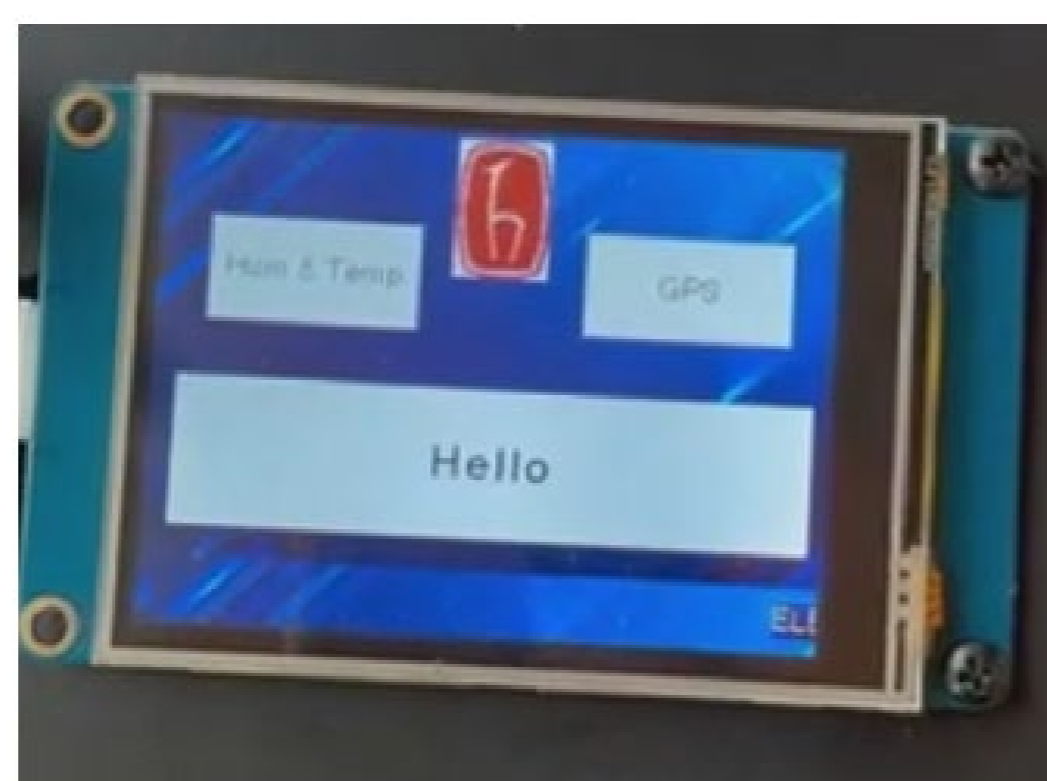
## Results and Discussion

- ❖ We carried out on the Hacettepe Beytepe road, I was able to reach a range of approximately 2.5 km thanks to the 3 LoRa system.



## Solution Methodology

- ❖ Communicating LoRa with SPI was the most important issue when designing the prototype. After we achieved this with STM32F103C8 microcontrollers by writing the necessary libraries, we aimed to make two separate LoRas talk. Later, we were able to transfer the data we received from the DHT11 temperature sensor in order to send meaningful data to the other module.
- ❖ LoRa modules were not working stably at the beginning, but later we took care of this with a few fixes. We have added a code that has the freedom to change variables such as bandwidth, Spreading Factor, Tx power output to make this system work at longer distances.
- ❖ Firstly, 2x16 LCD screen and numpad were used for the input from user but later it was decided to use HMI screen to solve power consumption.
- ❖ In the project, which initially aimed to communicate with two separate LoRa modules, it was later increased to 3 modules. In short, using a LoRa mesh network to increase the communication level to approximately 5 km by increasing the range with the module in the middle.



## References

- X. Xiong, K. Zheng, R. Xu, W. Xiang, and P. Chatzimisios, "Low power wide area machine-to-machine networks: key techniques and prototype," IEEE Communications Magazine, pp. 64–71, Sep. 2015.
- U. Raza, P. Kulkarni, and M. Sooriyabandara, "Low power wide area networks: An overview," vol. 19, no. 2, pp. 855–873.
- LoRa Alliance, <https://www.lora-alliance.org/lorawan-for-developers>, LoRaWAN Specification, 2016 ed.

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