

4 Summary

This paper was focused on the development process of a low-cost and modular RTK-GNSS receiver module. The need for such a device derived from the prices of current devices. The main purpose of this paper is to offer a low-cost and modular RTK-GNSS receiver module for high precision required positioning applications.

GNSSs, positioning techniques were described with detailed explanation and calculations are mentioned in sections 1 and 2 respectively. Modularity for flexibility and device's adaptability to various systems, low-cost for making RTK based applications accessible to everyone.

For the main processing unit ESP-32 based module selected both for its software community availability, its powerful processor for further development and being low cost. It also features SPI, I2C and multiple UART ports along with ADC and DAC capability. Its 240MHz clock speed, 520KB ram and 4MB of flash memory enable it to be future standalone RTK receiver. Even there is an SDK from Espressif for ESP32, current software development done in Arduino IDE. Arduino IDE made toolchain setup for this development easier and become more resourceful than provided SDK thanks to its community-based ESP32 ported libraries.

KiCad software is used for electronics schematics and further PCB production for being an opensource project. This makes the device completely opensource, after licensing software used in the device also opensource.

For testing UBLOX M8T is used and the device currently works only with it. For further development, receiver model number detection could be added with respect to their specific UBX commands. On the modularity aspect, a LoRa transceiver could be added to ESP32-WROOM via SPI port for further modularity and range improvement. LoRa is a low power wide area network technology that is used in the Internet of Things area [28]. It provides long-range radio link by consuming small energy. Its implementation makes the device used in long-range applications.