Design and Construction of a Location Tracking System and SOS Message Sender for Emergency Response

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ABSTRACT

Mountain climbing is a high-risk activity, especially in emergency situations such as getting lost, injured, or experiencing extreme weather. This research developed an Internet of Things (IoT)-based location tracking and SOS messaging system to accelerate emergency response in areas with limited signal. The system uses a NEO-6M GPS for location tracking, a BMP280 sensor for temperature, pressure, and altitude monitoring, and a LoRa SX1278 module as a long-range communication medium. Data from the sensor nodes is sent to an ESP32 gateway and forwarded to Node-RED via MQTT, then displayed on a web dashboard and sent as notifications to Telegram and WhatsApp. Test results show the system is capable of transmitting data in real time with high accuracy: the LoRa range reaches 760 meters in open areas, temperature sensor accuracy is 95.57–99.71%, air pressure 99.72–99.98%, and altitude 94.86–99.95%. GPS accuracy reaches 98.2–98.9% with an average difference of 11–18 meters. This system has proven effective and reliable in supporting emergency response in remote areas.

Keywords*: LoRa, GPS, SOS, Node-RED, Internet of Things, Mountaineering.*