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Intelligent Troop Status Monitoring and Location Tracking System Using Long Range Communications

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ABSTRACT: The major objective of this system is to identify the troop's location and the status regarding the climate conditions and the position of troops are monitored from remote place without any physical network connectivity by using the technology called LoRa. The available communication devices like Bluetooth, ZigBee, Radio Frequency and so on, which are all having limited distance coverage abilities. The term LoRa, which introduces a new medium and allows people to communicate from one end to other end without any interference and network requirements. LoRa indicates Long Range Communication, without any defined physical connections. The troops locations and their status regarding the climate conditions, position of troops are identified and reporting to control room via LoRa. Depending on the ratio grows to replace the traditional Communication schemes that take advantage of the remote wireless communications. LoRa based data sharing facility is a boom to the present innovative world. Long Range Communication technology is fastest, accurate and innovative as well as it covers long range without any interferences. It is the replacement of Classical wireless Frequency Modulated Communications. By using this LoRa we can do any innovative applications more efficiently.

KEYWORDS: LoRa, Long Range Communication, U-LoRa, LoRa WAN, Long-Range Communication

I. INTRODUCTION

Internet of Things (loT) has been initiated from enabling connectivity on edge devices, and providing new services which have not been available with reasonable cost. Key challenges in the realization of loT systems and applications are to minimize edge nodes deployment cost and maintenance cost. It is because the number of required edge nodes is much higher than that of hand-held devices. Wireless communication protocols, which are specially designed for loT applications, can minimize the hardware complexity and power consumption of edge nodes. Furthermore, cloud technology providing the common service frameworks can reduce maintenance cost of loT systems.

	Local Area Network Short-Range Communications	Low Power Wide Area (LPWAN) Internet-of-Tings	Cellular Network Traditional Machine-to-Machine
Ratio Use	40%	45%	15%
Advantages	Well Established Standard	Low Power Consumption Low Cost	Existing Coverage High Data Rate
Disadvantages	Battery Live, Cost	Emerging Standard	Autonomy, High Cost
Examples	4.0 Bluetooth, Wi-Fi	LoRa	3G, 4G

Fig. 1. The place of LPW AN in loT wireless connectivity ecosystem.

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Fig.l shows the place of LPWAN in loT wireless connectivity ecosystem whilst Fig. 2 demonstrates the block diagram of a low-power long-range transceiver module SXI276/77/78/79, operating at 137 MHz to 1020 MHz. In accordance to possible communication ranges, two wireless communication protocols can be classified into two categories, I.e. (i) short-range and (ii) long-range communication protocols. On the one hand, WiFi, Zigbee, and Bluetooth represent the short-range communication protocols, which are suitable for indoor environments. On the other hand, long-range communication protocols can be deployed using LoRa communications. Typically, LoRa W AN has three classes of end-point devices to address different needs reflected in wide range of applications as follows; First, class A or a bi-directional end-device in which end devices allow for bi-directional communications whereby each end-device uplink transmission is followed by two-short downlink receives windows.

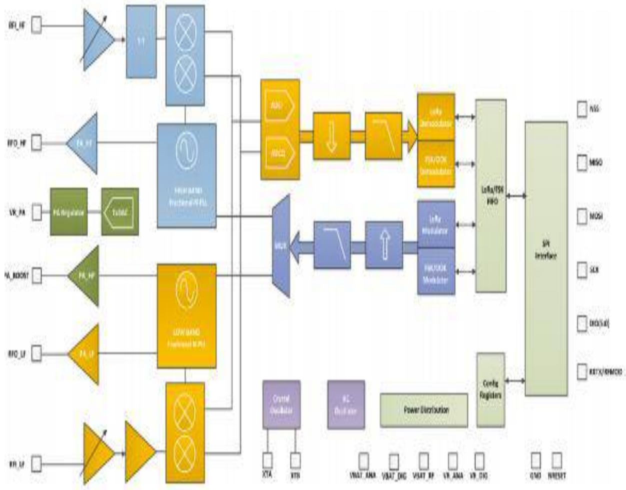

Fig. 2. The block diagram of a low-power long-range tranciever module SX I 276177178179, operating at 137 MHz to 1020 MHz

This class A operation is the lowest power end-device system for applications that require downlink communication from the server shortly after the end device has sent an uplink transmission. Second, class B or a bidirectional end-device with scheduled receive slots. Such a class B device opens extra receive windows at scheduled times. In order for the end-device to open receive window at the scheduled time it receives a time synchronized Beacon from the gateway. This allows the server to know when the end device is listening. Last, class C or a bi-directional end-device with maximal receive slots in which end-devices have nearly continuously open receive windows, only closed when transmitting.

II. LORA – A SUMMARY

Mohamed Are! and Axel Sikora presented a short overview on the technologies to support Long Range (LoRaTM), and described the outdoor setup at the Laboratory Embedded Systems and Communication Electronics of Offenburg University of Applied Sciences. It was found that the range directly depends on the link budget, which can be increased by the choice of modulation and coding schemes. The SX127x family from Semtech Corp. is a member of this device class and promises significant benefits for range, robust performance, and battery lifetime compared to competing technologies. Juha Petajajarvi at al., studied the coverage of the LoRa LPW AN technology through real measurements.

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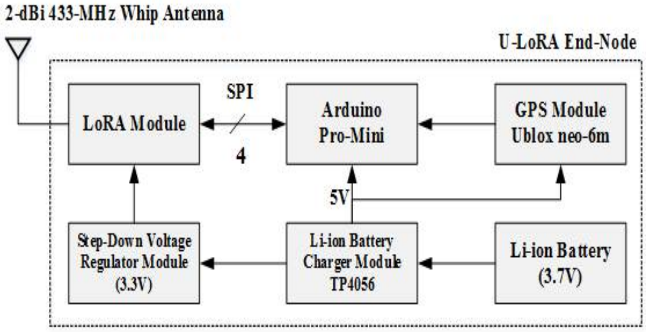

Fig. 3. Block diagram of the proposed Universal LoRA End-Node with GPS Module.

The experiments were conducted in the city of Oulu, Finland, using commercially available equipment. The measurements were executed for cases when a node located on ground or on water reporting their data to a base station. The node operate in the frequency range of 868 MHz ISM band using 14 dBm transmitting power and the maximum spreading factor. The maximwn communication range was found over 15 km. on ground and close to 30 km. on water. Recently, Thomas Wendt et aI., employed EM Microelectronic developed a LoRa nLmodulation chip called EM910 1 for the 2.45 GHz frequency band, which is based on the Semtech technology.

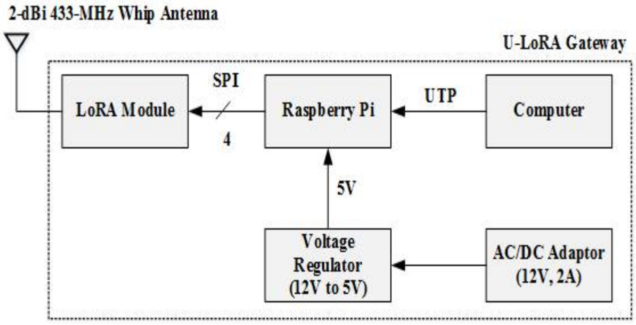

Fig. 4. Block diagram of the proposed Universal LoRA Gateway connecting to a computer

This transceiver-modern-design offers an ultra-long range spread spectrwn communication and high interference robustness. The spread-spectrwn technology is not new, but implemented into a 2.45 GHz frequency based chip which can be taken as add on modem to a standard transceiver chip. The gain for the air-link budget which is more than 20 dBm can be utilized to obtain a huge communication distance. This paper therefore presents the long-range communication system that comprises not only the implemented gateway using Raspberry-Pi but also an end-device using micro controller with GPS and other sensors for geological and physical tracking. The proposed system employs four gateways with bridge-tobridge WIFI connection for communication to the server. The end node can be integrated more than ten types of sensors such as GPS, Temperature, Humidity, and water sensors. All data can be visualized real-time via monitor station. The proposed system provides not only an emerging long-range communication but also low-power operation in a military campsite within 1.5 kilometers.

III. EXISTING APPROACHES – A SUMMARY

In existing system we all know the communication such as Bluetooth, ZigBee and Radio Frequency (RF). All these communications are falling into certain limitations such as range and speed. GSM is an option to tolerate the range, but it cannot be used without network. Slower Communications between transmitter and receiver end. Performance is low, because of its time taken procedures and Cost is high. Internet is the only option to perform the

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long range communications. The existing approaches contains lots of disadvantages, some of them are listed below: (a) Limited in Range, (b) Cost wise expensive while coming to practical implementations, (c) Circuit complexity is more while enabling the service to large distances via classical wired devices and (d) Practically impossible to extend the range higher and higher, simply scalability is not possible.

IV. PROPOSED SYSTEM SUMMARY

Advanced Long Range Communication (LoRa) technology is used instead of regular network based communication principles. It can be used in both indoor and outdoor communication system. Speed is amazing and unpredictable compare to the other communication devices. Good in Performance because of its fast transmission. Circuit Designing is simple and Cost effective. The proposed system contains lots of advantages, some of them are listed below: (a) Range is comparatively higher and persistent, (b) Financially more convenient in practical implementations, (c) Circuit Complexity is less and (d) Performance is so good compare to the classical systems.

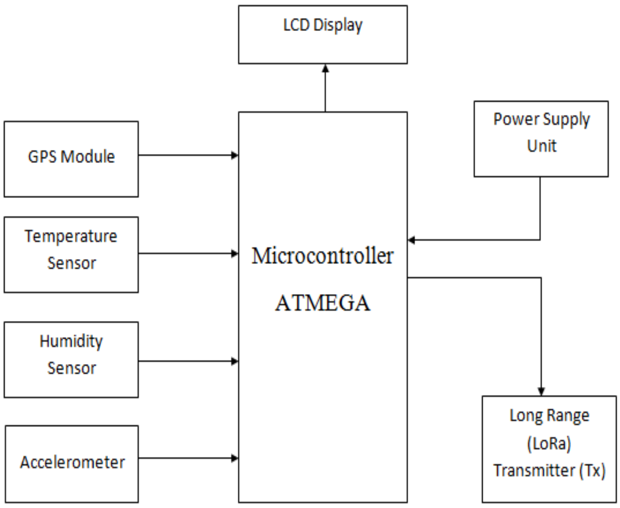

Fig.5. Block Diagram – Transmitter End

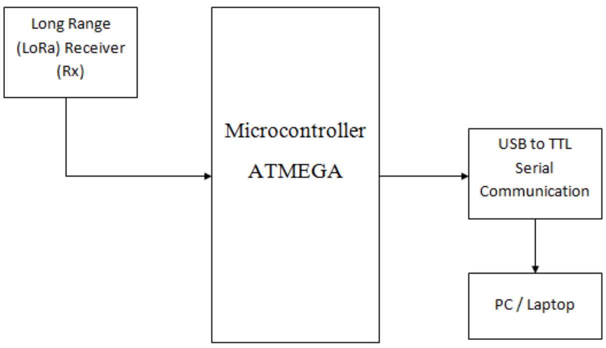

Fig.6. Block Diagram – Receiver End

V. LITERATURE SURVEY

In the year of 2014, the authors "Z. Chen, Y. Wang, L. Liao, Y. Zhang, A. Aytac, J. H. Muller, R. Wunderlich and S. Heinen" proposed a paper titled “A System C Virtual Prototyping based methodology for multi-standard SoC

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functional verification", in that they described such as: a functional verification methodology for multi-standard wireless Systems-on-Chip (SoC) based on SystemC Virtual Prototyping (VP). The proposed semi-automatic pin-accurate RF VP generation method reduces huge handcrafting work to abstract circuitry into the event-driven simulation domain with satisfactory accuracy, while enabling the flexibility to choose different abstraction levels. A seamless transition between various signal abstractions is enabled by operator overload, e.g. pass band and equivalent baseband in order to minimize simulation time according to test cases. This methodology is demonstrated for a low power RF transceiver with the achieved simulation speed of 500µs in 10s computation time.

In the year of 2016, the authors "E. Fraccaroli, M. Lora, S. Vinco, D. Quaglia, and F. Fummi" proposed a paper titled “Integration of mixed-signal components into virtual platforms for holistic simulation of smart systems", in that they described such as: now-a-days, the design of applications based on smart systems requires the joint simulation of both digital and analog aspects. Even if analog-mixed-signal (AMS) extensions of hardware description languages are an enabling factor, they do not provide a general methodology for the integration of AMS models into digital virtual platforms.

This system defines the problem and provides two main contributions: 1) the automatic conversion of analog models from Verilog-AMS to C++/SystemC, to remove the overhead of co-simulation with traditional virtual platform tools, and 2) the automatic abstraction of analog conservative models, with the goal of increasing simulation speed. Experimental results show that the virtual platform with automatically integrated analog components is 40 times faster than co-simulation with Verilog-AMS, and the increase of speed due to abstraction is more than 100%.

In the year of 2014, the authors "F. Fummi, M. Lora, F. Stefanni, D. Trachanis, J. Vanhese, and S. Vinco" proposed a paper titled “Moving from Co-Simulation to Simulation for Effective Smart Systems Design", in that they described such as: design of smart systems needs to cover a wide variety of domains, ranging from analogue to digital, with power devices, micro-sensors and actuators, up to MEMS. This high level of heterogeneity makes design a very challenging task, as each domain is supported by specific languages, modeling formalisms and simulation frameworks.

A major issue is furthermore posed by simulation, that heavily impacts the design and verification loop and that is very hard to be built in such an heterogeneous context. On the other hand, achieving efficient simulation would indeed make smart system design feasible with respect to budget constraints. This work provides a formalization of the typical abstraction levels and design domains of a smart system. This taxonomy allows identifying a precise role in the design flow for co-simulation and simulation scenarios. Moreover, a methodology is proposed to move from the co-simulated heterogeneity to a simulatable homogeneous representation in C++ of the entire smart system. The impact of heterogeneous or homogeneous models of computation is also examined. Experimental results prove the effectiveness of the proposed C++ generation for reaching high-speed simulation.

VI. CONCLUSION

The exploitation of LoRa Transmitter and Receiver results in commissioning procedures for data oriented communications and commissioning time is drastically reduced. With this configuration, data transmission configuration is more ease to use without network oriented communications are also possible. For all the result of this system is a data based efficient LoRa Communications with innovative transceiver unit. The experimental results prove the efficiency with Time, Range and accuracy parameters.

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