Implementation of RFID Based Train Localization

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Abstract: This paper demonstrates the performance from the GNSS receiver for train localization. The 2 kinds of performance qualities have to be migrated to form appropriate qualities for GNSS in railway programs. Therefore, for that approval from the railway government bodies, a localization unit composed by GNSS receiver and Doppler radar sensor together is going to be enough to satisfy the needs. First, the GNSS performance and railway RAMS properties are in comparison by definitions. This train localization function should adhere to railway functional safety standards thus, the GNSS performance must be evaluated in in line with railway EN 50126 standard [Reliability, Availability, Maintainability, and Safety (RAMS)]. Many scientists are growing GNSS to safety-related applications in surface transportation [2], for instance, railway train control systems Global Navigation Satellite Systems (GNSS) are applicable to deliver train locations instantly. Second, the GNSS receiver measurements are categorized into three states (i.e., up, degraded, and faulty states). The relations between your states are highlighted inside a stochastic Petri internet model. Finally, the performance qualities are evaluated using real data collected on the railway track in High Tetra Mountain tops in Slovakia. This paper is aimed at evaluating GNSS receiver for train localization performance. In addition, a universal evaluation methodology does apply on other train localization sensors. The property evaluation is dependent on the definitions symbolized through the modeled states.

Keywords: Evaluation; Global Navigation Satellite Systems (GNSS); Quality Of Service; Railway Reliability;

I. INTRODUCTION

This paper is aimed at evaluating GNSS receiver for train localization performance. In addition, a universal evaluation methodology does apply on other train localization sensors. Global Navigation Satellite Systems (GNSS) happen to be widely used in surface transportation, for instance, vehicle navigation, railway fleet management, and stop passenger information [1]. Many scientists are growing GNSS to safety-related applications in surface transportation [2], for instance, railway train control systems. Figuring out train locations as precisely as you possibly can may be the fundamental Requirement of it GNSS receiver is really a practical instance for performing train localization function. Additionally, odometer, Doppler radar, another sensors may be used together to provide better and also safe train locations. These sensors were installed on the train rather of along the track, thus providing the possible ways to locate the train much more precisely, lowering the constant maintenance work across the track, and enhancing safety. The quantified performance values could be in comparison and integrated to forma safe train localization unit. Overall, the GNSS performance needs to be evaluated first. GNSS localization service has set needs into four qualities: precision, continuity, availability, and integrity [3]. When things receiver, and various other localization sensors, fulfill the requirements, GNSS is a promising localization source for safety-related applications in a variety of transportation systems [1]. Railway applications demand the illustration showing Reliability, Availability, Maintainability, and Safety (RAMS) qualities as mentioned in EN 50126 [4]. The 2 kinds of performance qualities have to be migrated to form appropriate qualities for GNSS in railway programs. Getting a security situation involved evaluation methodology that’s consistent with the factors may lead GNSS receiver to become approved by railway government bodies and assessment physiques [5]. Researchers have been doing GNSS for railway safety-related programs using EGNOS data or by simulation techniques. Filipe al. examined EGNOS performance and allotted the potential risks using fault tree, and completed RAMS evaluation techniques weren’t mentioned. However, the job sets up first example for evaluating GNSS performances for railway programs. Begin and Marais evaluated GNSS performances in railway by simulation techniques, availability and reliability aspects of different conditions are examined, and safety isn’t an issue [5].

II. PERFORMANCE PROPERTIES MIGRATION

Both GNSS and RAMS performance characteristics have been proven in parallel.
Among the characteristics, only availability is strictly the same term the relaxation from the six characteristics needs to be examined, formally compared, and then migrated. Precision rentals would be the bottom for GNSS receiver location performance. It might be symbolized by two characteristics, i.e., trueness and precision. Trueness notifies the deviation involving the measured value and the actual value the actual value is symbolized having a value measured by a multisensory reference system. The mean value of the deviations is denoted by \( \mu \). Precision is usually calculated through dispersion of measurement samples, referred to as standard deviation. Continuity and reliability characteristics derive from their definitions. Continuity is required by GNSS performance as ale the total system to complete its function whole time during the intended operation [3]. Reliability is required by railway RAMS and the definition originates from IEC 60050 as ale an item to perform a needed function under given conditions for just about any given time interval [1]. The terminological difference can be obtained between “without interruption” and “required function”. GNSS for train localization requires not only continuous locations however the needed accuracy level to fulfill the “required function”. Availability property ought to be evaluated from both performance requirements. The saying availability is pointed out according to IEC 60050 as ale a product to get inside a condition to Performa needed function under given conditions inside a given instant of timer around the as time passes interval, supposing the appropriate external resources are provided. Maintainability rentals aren’t launched by GNSS receiver location performance since the GNSS signal wide (SIS) is not maintained by finish clients [1]. Therefore, in this particular paper, taking care of GNSS/SIS is not considered. Finish-user equipment’s demand integrity since maintenance is not included. Integrity is described as the trueness in the information supplied having a localization system [3] which means that integrity is related to measurement deviation. Safety property from the railway applications thought as freedom from unacceptable harm [4] this suggests the quantified price of harm. Safety integrity is described as a quantifiable property because the chance to attain needed safety functions under all the stated conditions in the pointed out operational atmosphere and within stated time period of time The four characteristics concerning GNSS for train localization performance are formalized into characteristic equations by their definitions. The appropriate four characteristics for evaluation are precision, reliability, availability, and safety integrity. The “required function” and “given condition” are usually pointed out for every equation “required function” is judged by GNSS location precision level, and “given condition” is related for the railway operation atmosphere this is the railway track type.

![Fig.1 Reference system Architecture](image)

**III. PERFORMANCE PROPERTIES MODELING**

The migration procedure for the performance qualities provides a clear direction from the qualities to become evaluated, however the equations are still in context form thus in a roundabout way quantifiable. This modeling section brings measurement values right into a formalized model for structuralized performance evaluation.

**A. Presumptions:** GNSS receiver is assumed, of course, powered on, and GNSS receiver hardware is running without systematic failure. Therefore, the failures from the train locations come from SIS, directly reflected on the deviations. To be able to measure deviations of GNSS receiver locations, corresponding reference locations are essential. Reference locations are assumed just as much better than GNSS receiver locations. The performance from the reference system won’t be mentioned within this paper more information are available in the dissertation by Poliakand a paper by Wegener and Schneider [4].

**B. GNSS Receiver and Reference Locations:** The GNSS receiver calculates location using received SIS. The reference system integrates information from the 3 location sensors and matches having a digital track map, thus producing reference location.

**C. Modeling of do Into States:** Based on the migration section, “required function” is judged by accuracy level, a suitable precision degree of the deviation can be abstracted as d1, and also the quantified harm from the localization function can be produced from another precision level as d2. Both precision levels separate GNSS receiver locations into three states.

**IV. CONCLUSION**

This paper has proven a means to evaluations performances based on standards, particularly RAMS. GNSS is considered as an essential...
demonstration of future train localization to eliminate trackside equipment’s and implementing next-generation European Train Control System Level 3. Hence, GNSS will have a vital role in complete safety-related programs, including train localization. A stochastic Petri internet model is made as one example of the GNSS receiver location states, i.e., up, degraded, and faulty states. The performance of the localization unit can as well be evaluated while using methodologies proposed within this paper. Because of the analysis, the methodology for performance evaluation based on standards and also the setup of the reference system together can promote a standardized test scenario and procedure forges quantitative checks later on.

V. REFERENCES


