IoT Based Multisensory System to Enhance Railway Safety

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Abstract - *Due to the continuous development of the high-speed railway lines and the growth of automatic systems, it is becoming more and more necessary to install safety elements to prevent accidents. For that purpose, this project proposes the design of a multisensory system, which consist of infrared (IR) and ultrasonic (US) sensors, which are placed at opposing sides of the railway tracks, respectively, in order to establish optical and acoustic links between them. When the train arrives at the particular location then the details about that train will be given from the database. Now, check the train details, if match then and only then, the parameters will be measured and the speed of train regarding to that parameters will be sent to the loco pilots display. In the parameters, this project measures the rainfall in mm, temperature, fog, humidity and route vibrations. Also, the time required that present train to pass that location will be measured. On the basis of these all parameters, the allowable speed of the train at that particular location will be sent to the loco pilot. In addition, all these information will be sent to the database. Now, information about train will be sent to another train which will be next arrived at that location. If there is any change in parameters, then according to that parameters allowable speed of train will send to that trains loco pilot.*

Thus, with the help of multisensory system, we can enhance the railway safety.

Key Words: **Internet of Things, Smart railway, Condition based maintenance, Power consumption, Coverage**

1. INTRODUCTION

Railway has been playing a important role of public transportation from 19'th century, in this a steam locomotive began to be run. From that moment, the railway was regarded as a core method to transport population moving along the determinant paths within and between metropolitan cities. The basic technology of the railway has been so far progressed and enables a high-speed railway system which satisfies the public demand on traveling a long distance. The railway possesses the inherent characteristics of huge capacity and energy efficiency, and those merits motivate the governments of many countries to encourage and support the railway for public interest. The governments take into account the railway vital once they establish transport policies. One of the important problem for railway operators is maintenance of their railway systems. As the railway system content of various entities including train vehicles, tracks, facilities (i.e. tunnels and bridges), catenaries and electrical devices in trackside. It is necessary for the railway operators to guarantee that every entity of the railway system operates in good condition. Any operational damage are supposed to be strictly prevented, because an unexpected fault may threat the security of passengers. Due to this fact, the government forces the railway operators to totally engage themselves in conducting the maintenance.

Securing safety of passengers is a very important task to train operating company. To date, many different approaches have appeared. In this work, two approaches are introduced. First approach is based on integrated use of multiple sensors. These sensors provide location information with much more increased precision. These approaches can be used with other methods to provide elevated level of safety to passengers.

Recent trend of railway train development can be characterized in several aspects: high speed, infotainment, intelligence in driving, and so on. In specific, trend of high speed in driving is prominent and competition for high speed amongst several techno-savvy countries is becoming severe. To achieve high speed, engines or motors are distributed over multiple vehicles of train to provide increased motive power, while a single engine or motor has been mostly used for conventional trains. Increased speed and more complicated power train system naturally incur much higher chance of massive accidents. From this angle, importance of proactive safety control before accident takes place cannot be over-emphasized. To implement proactive safety management needs situation-aware integration and transmission of safety info obtained from IoT sensors. Types of essential IoT sensors depend upon situational conditions. Thus, integration and transmission of safety info ought to be performed with IoT sensors providing the security info correct for long-faced state of affairs. This work is to devise a methodology how to operate IoT sensor network enabling proactive safety control for railway vehicles.

1.1 Motivation

While railway technology has evolved slowly over the last two hundred years, future few years might bring bigger transformation to the railways, and at a bigger pace than we tend to have seen within the past as railway operators begin to adopt net of Things technologies. This paper outlines a number of the innovations that we tend to might even see within the railways - and specifically on board trains - and

therefore the options of the electronic hardware that will be required to deliver these forms of services.

We will examine however the surroundings on board a moving train differs from the everyday operational surroundings for associate IT or electronic system, and description four key factors that must be thought-about within the style of electronic systems which will be used on board a moving train.

1.2 Literature Review

An automatic train protection is one that helps to anticipate collisions with speed restrictions and applying brakes. To boost the system availableness inside the on the market the web of Things may be a system that permits varied physical devices, sensible devices, vehicles additionally referred to as connected devices that are interconnected with each other via internet. IoT consists of varied softwares, sensors that enables to collect and exchange data. It enables the connected devices to collect data and exchange them. IoT creates direct communication of the existing physical world into the computer systems. IoT provides the aptitude that allows the objects to be remotely monitored, controlled and sensed across the network due to which there is improved efficiency, accuracy, less human intervention and a lot of dependability as a result there are economic advantages likewise The factor word employed in IoT can be Associate in Nursing object that have the power to gather and transfer data over a network while not manual intervention or help. Internet of things will connect completely different devices that are embedded in numerous systems to the net. These devices are appointed IP addresses to unambiguously establish them. Eg. Automobiles with in-built sensors to trace their location. The property then helps North American nation capture additional information from additional places, guaranteeing additional ways in which of skyrocketing potency and up safety and IoT security. The organizations can be benefitted a lot by IoT as they can help them in improved process efficiency, utilization of assets and productivity. With the ability to connect various devices or objects using sensors and connectivity, they can prove to be beneficial from real time insights and analytics., which would help them make smarter decisions.

1.3 Evaluation

1.3.1 Internet of Today

Manufacturers are connecting things to before we referred to as it the web. By the mid-1990s, Web servers were being added to embedded products. Current M2M makers are desegregation Internet-connected systems into high-value plus trailing, alarm systems, fleet management and the like for more than 15 years. These M2M systems area unit difficult to create despite the fact that some area unit supported trade commonplace protocols. However, it's obtaining easier to integrate M2M systems as additional powerful processors area unit incorporated into the tip nodes. And since these processors support high-level in operation systems (OSes) and languages, the platform can leverage intelligent frameworks. These systems area unit generally tied into high-end business service layers and area unit managed by a network operations center (NOC).

1.3.2 IoT of Tomorrow

The edifice wherever I even have a reservation is aware of I am returning and also the approximate time of my arrival as a result of I even have allowed Apple and Google to trace my location. It also knows that I am hot and sweaty from my trip because of the temperature and moisture sensors that are part of my smart watch. The bedroom i'll keep in is presently dormant (no lights, drapes closed, the temperature is at optimized dormant levels). Upon my arrival, the valet is aware of it's Pine Tree State. He opens my door and also the automobile adjusts the seat as a result of it detects the valet. My preference is to hold my very own bag, thus I am not accosted by the supervisor. Once in proximity of the edifice lobby, a secure key app is on the market on my smartphone. By the time I reach the elevator, the space temporary worker has adjusted to coincide with my smart watch sensors. The light level, music and privacy settings are to my necessities. Because I am hot and perspiring the space conjointly prepares quandary for a shower I'll most likely take when getting in the space. As I approach, the secure key app unlocks the space door. Once settled for the night, {the room the space the are} detects the lights are clothed, it changes the temperature setting to my sleep preferences. In this situation, each space during this explicit edifice chain has multiple sensors and actuators. Every rental car has multiple sensors and actuators. I am sporting multiple sensors and actuators, like a watch vibration for alerts. I am not interacting with my smartphone touch screen perpetually to direct these connected things to require actions even supposing it's one entrance for my activity. There will be uncountable individuals doing this on a daily basis. We will be living IN the data. This vision of IoT won't happen at once. The scale needed can solely be achieved by making a lowest common divisor, straightforward electronic communication theme that everybody on the world can conform to. It will have to be digitally organic, imitating nature. At present, technology protocols and knowledge structures are restricted by their style complexness additionally as security, extensibility, and much more. Our connected devices can have to be compelled to become easier to use even supposing the complexness of the devices can increase. The line between analog and digital will blur. Every person on the world are ready to "author" his or her own life atmosphere, even supposing they apprehend essentially nothing regarding the underlying technology.
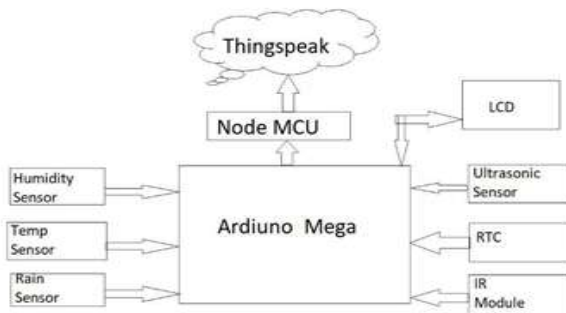
2. Block Diagram

Fig -1 Proposed System Architecture for transmitter

When a train begins its operation, it needs to perform self-diagnosis to ensure initial safety control. When it is in operation (in driving), various types of IoT sensors for monitoring collect data to proactively perform safety control. Interior IoT sensors, such as humidity sensor and fire sensor, for regular monitoring can take constant or close to constant data collection rates. Communication network within a vehicle can be formed in a combination of wired and wireless connections of IoT sensors. Some of the IoT sensor data are utilized for actuators without data transmission to external network and other data collected from sensors are transmitted to external network. To deliver the IoT sensor data in an orderly manner, a single or multiple gateways of a train to outside communication networks. The all collected data in sensors are transmitted to cloud server through node MCU. This architecture is beneficial when the number of sensors is large and coverage of whole sensor network is also large to some extent.

Channel access for IoT sensor network can be prioritized according to data type and the priority of sensor data depends on situation even when they are obtained from the same sensor. Safety-critical IoT sensor data can be immediately transmitted to the external network by assigning a higher priority in contention or special time slots or even a separate gateway. In transmitter side all the data is transmitted to receiver thing speak server and it shows the data in LCD to the railway pilot.
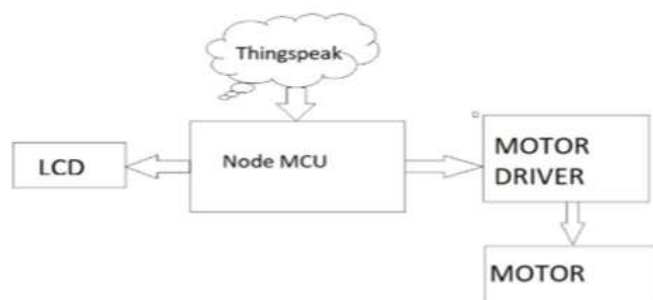

Fig-2 Proposed System Architecture for receiver

3. CONCLUSION

In this paper, a configuration is planned that may avoid the accidents that may be caused thanks to the broken tracks. Since with the enlargement of railways and large increase in variety of trains the main drawback rising is that the maintenance of the tracks. With the upper frequency of trains running on tracks the possibilities of developing damages within the tracks are terribly high. Solely betting on manual work is time taken and typically may also be life risky. Also with the restricted variety of workers it's terribly tough to spot the matter and solve it in restricted time. Since the railway networks are terribly wide swollen with restricted manpower so the possibilities are terribly high that tracks fractures might get forgotten. If these harm gets unheeded then a serious mishap might occur. IoT and cloud computing are 2 major advancements within the technology that may facilitate solve this drawback. This technology isn't solely reliable however conjointly value effective as compared to manual expenses. Since this technology would cost a good amount therefore it can be implemented in the regions where the train frequency is very high as they are very prone to develop fractures. For example in Cities. In rural areas where trains frequency is very less and thus chances of rail fracture is very low, manual work may success.

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