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Sensors Implementation in AGV & IoT based Data Visualization over Client Server Architecture

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Abstract – *The Internet of Things (IoT) is a rapidly expanding technology that is shaping up to bring the next revolution in computing and information technologies IoT has wide range of applicability in industries and it is flexible in any given environment. In recent years with the development of Internet technology, the Internet of things (IoT) has begun to apply to each domain. In the era of IoT, the proliferation of devices such as RFIDs, actuators and sensors has enabled a specific paradigm. Smart devices are used effectively in the environment to monitor and collect ambient and resourceful information. This project introduced the idea of how to apply IoT to AGV'S (Automated Guided Vehicles). These vehicles are mainly useful for material handling and floor transportation purpose. The AGV automated guided vehicles have huge demand in the manufacturing industry. IOT based AGV, is connecting the AGV with the help of internet which is part of industrial 4.0. The vehicle has different sensors installed in it, it does not only introduce the idea to analyze, process and store the sensors data but also transferring real-time data using IoT. Due to this noteworthy feature, a user can view each specific sensor data and it's visualization with the help of the web server system.*

Key Words: Industrial IoT, Internet Of Things, Industry 4.0, Smart AGV, Data visualization using IoT, Raspberry Pi

1. INTRODUCTION

Automated guided vehicle is a special type of mobile vehicle used in floor transportation and material handling of manufactured or raw materials. Conventionally AGV was used only in the manufacturing system, but as the rapid changes in technology, now as per the user requirements, AGV can be designed for various applications. As the big leap towards the Industry 4.0 this system provides the data visualization of real-time AGV parameters with the help of internet-enabled dashboard. The parameters like AGV Uptime, Charge left, time left, distance travelled, current speed, maximum current consumed, current temperature, as well as the average values of temperature, speed can be calculated and displayed with this dashboard. Sensors like current sensor, voltage sensor, temperature sensor and speed encoder are used to calculate these values.

1.1 Problem Statement

A current version of AGV does not provide any facility to store, analyze & visualize sensors real-time data. Because of lack of facility, a user cannot able to see the current status of AGV i.e. battery voltage & current levels distance travelled, speed, temperature etc. Eventually absence of 'Data monitoring & visualization' process, which leads to poor data handling and processing capacity.
So this system proposes:

- Storing these sensors real-time values into the local database.
- Sending these values to the server.
- Real-time data visualization using IoT dashboard.

1.2 Objectives

- Enable the IoT feature by sending real-time parameters to the server.
- Real-time data visualization using IoT dashboard.
- Monitors AGV's internal activities from anywhere.
- Simultaneously stores the real-time sensors parameters into the database when the system is offline.
- When the system gets into online mode fetch the data from the database and send it to the server.

2. HARDWARE INTERFACES

2.1 Industrial Shield m-duino plc

This plc has 34 I/Os. It is also having several communication ports which provide more flexibility and control making it a most reliable options for the basic as well as industry standard based projects too. The unique feature of this PLC is it can be programmed using the Arduino IDE platform. The PLC can be programmed using USB port and remotely it can be programmed using Ethernet port too.

2.2 Raspberry Pi 3 Model B+

It is the small single board computers developed in the United Kingdom by Raspberry Pi Foundation. Raspberry pi 3 is the latest version which operates on 1.4GHz 64 bit quad-core processor, 1GB LPDDR2 SDRAM, 2.4GHz &5GHz IEEE802.11 WLAN, 4 USB 2.0 ports & extended 40-pin GPIO header.

2.3 Current Sensor

This sensor is working on Ampere's and Faraday's laws. A loop is placed around a current carrying conductor and the voltage is induced over the loop which is proportional to the current. This sensor is mainly designed for 100A-1000A load currents.

2.4 Temperature Sensor

The LM35 series is known as a precision integrated-circuit temperature sensor, it produces an output voltage which is linearly proportional to the Celsius (Centigrade) temperature. It can measure the temperature ranging from -55 to 155 Celsius.

2.5 Speed Encoder

It is an electromechanical device which is useful for speed measurement. According to the output signal, the encoder is divided into the two parts namely as incremental and decremental. In speed encoder, the pulse frequency is directly proportional to the rotational velocity.

3. SOFTWARE INTERFACES

3.1 Python IDLE

Python IDLE is Integrated Development Environment which is mainly use for editing and running python programs(Python2.x/Python 3.x). Python interpreter is automatically installed with IDLE. IDLE comes with number of features to help us to develop Python programs including powerful syntax highlighting.

3.2 Arduino IDE

Arduino comes with both a physical programmable circuit board and software that runs on our computer. Mainly useful to write and upload the code to the physical board.

3.3 Microsoft Power BI

Power BI is a cloud-based self-service business intelligence tool which comes with powerful and interactive visualization faclity .With the help of Power BI you can analyze and visualize data. It is provided with the facility of adding your data sources from excel, power BI dataset, SQL server, Web, Text/CSV, Oracle database, MySQL database etc.

4. PROPOSED SYSTEM DESIGN

This IoT based data visualization system will not only help to store the real time sensors data of AGV but also to send it to the server for the data visualization and monitoring purpose.

Various types of sensors (voltage, current, temperature, speed encoder) are interfaced with the industrial shields m-duino plc in order to calculate the parameters like speed, distance travelled, temperature, uptime, battery voltage and current level. Using serial communication these parameters are send to the raspberry pi board and stored into the local database created in raspberry pi board. After receiving this real time data from m-duino plc firstly it is stored into the database and simultaneously it will fetch from the database and send it to the server system.

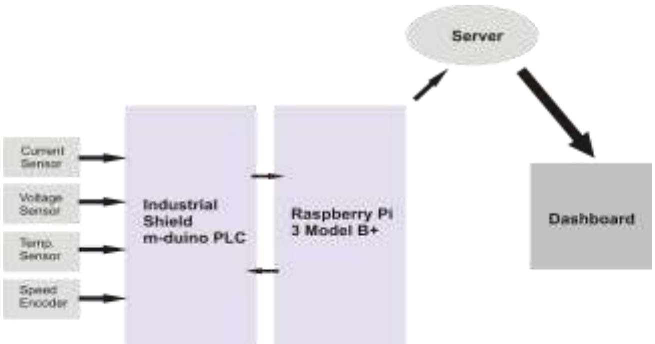

Fig-1: Block diagram of proposed system

The pretreatment of storing this data is for the sake of offline data storage facility, means whenever system is not connected to the internet the data which is continuously coming from different sensors will stored into the database one by one and whenever system will again connected to the internet these data can be fetched from the database, the manner in which is it is stored(like Stack FIFO) with it's equivalent timestamp so there will be no any data lost. From the server this data will again transferred to the dashboard for the visualization and monitoring purpose.

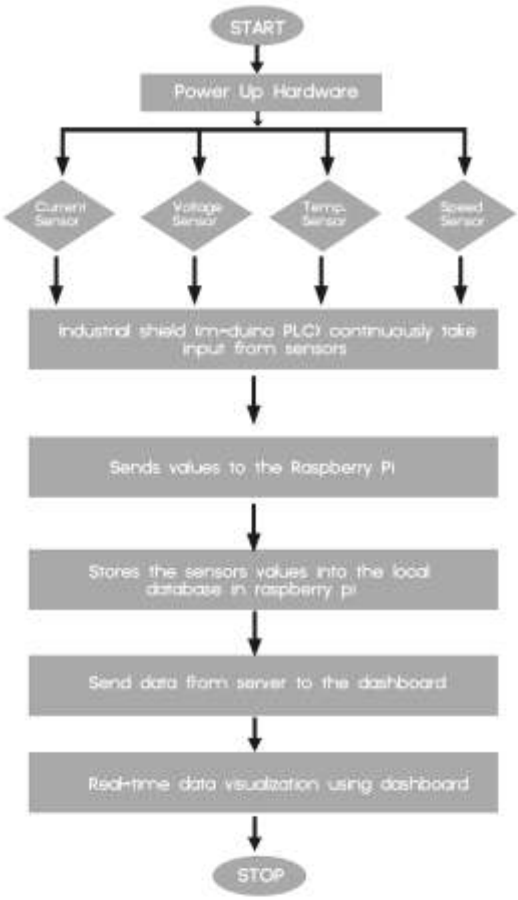

Fig-2: Flow chart for the system

5. FEATURES

- Real-time performance and monitoring.
- Comprehensive visualization of machine parameters.
- Ready access to historical data pertaining to vehicle efficiency.
- Precise realization of equipment efficiency.
- Remote access to vehicle data from any corner of the world.

6. RESULTS

This systems as its related to Industry 4.0, displayed the real time values of different sensors with the help of dashboard. Using this dashboard we can easily analyze the different parameters and status of the vehicle.

Fig-3: Main Dashboard (Current Values) of the system

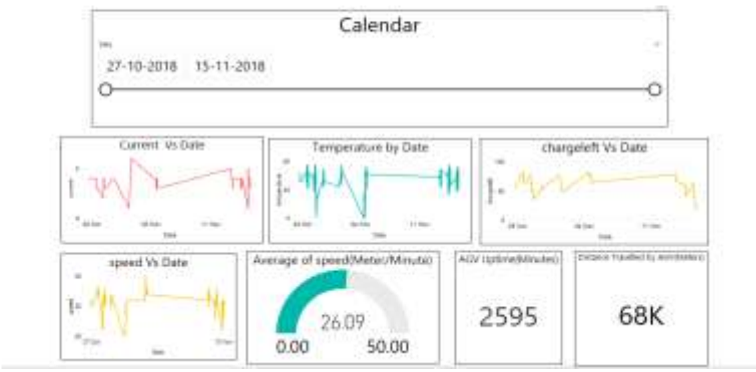

Fig-4: Dashboard of the system(Graphs, Average Values)

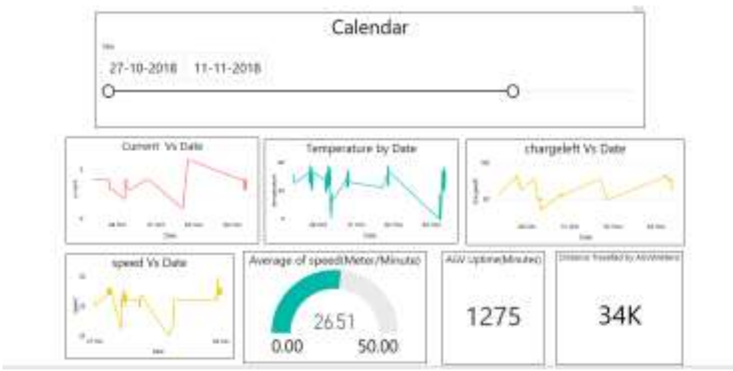

Fig-5: Selection of particular time stamp facility in the dashboard(1)

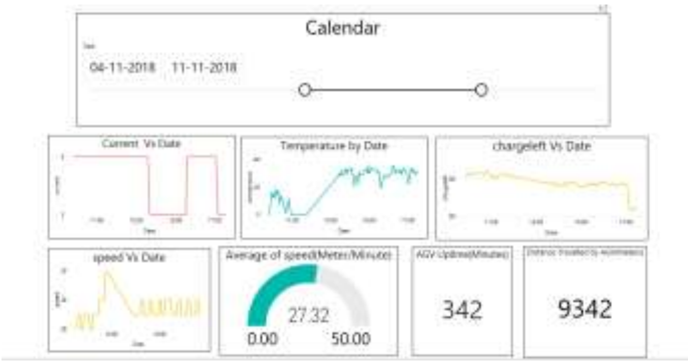

Fig-6: Selection of particular time stamp facility in the dashboard(2)

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