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ARDUINOVIA IOT TECHNOLOGY IN LOGISTICS FOR DECISION MAKING

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ABSTRACT

In this paper, we will explore some of the exciting uses of IoT in the supply chain. The logistics industry is a key player that is ready to take advantage of the "IoT" revolution. With millions of missions being moved, tracked, and stacked by a variety of machines, vehicles, and people every day, it is no surprise that logistics and the IoT are in perfect harmony. In addition, transport was and is the weakest link in terms of logistics due to the limited security measures available for the safe delivery of cargo. Using IoT technology via wireless sensor networks to communicate between sender and carrier, logistics providers can view and manage their cargo and drivers on a much larger scale, whether it is the condition or location of goods. So, using this network infrastructure and technological advances in wireless sensor networks (WSN), administrative processes can be managed much more efficiently and effectively. In conclusion, the IoT takes the supply chain to a more sophisticated level as it provides an accurate flow of product information to the market, a reliable basis for analysis, forecasting and proper management decision making.

KEYWORDS: *IoT, Logistics, Arduino, Decision Making*

INTRODUCTION

The logistics industry is a key player that is ready to take advantage of the "IoT" revolution. With millions of missions being moved, tracked, and stacked by a variety of machines, vehicles, and people every day, it is no surprise that logistics and the IoT are in perfect harmony. In logistics, the "IoT" can link different assets along a supply chain in a meaningful way and then analyze the data generated by those links to capture new ideas. In this way, "IoT" enables logistics providers to unlock higher levels of business efficiency, while through decision-making they create customized, dynamic, and automated services for their customers.

LITERATURE REVIEW

Recent leaps and bounds in microelectronics, which not only reduce the size and weight of various data processing and storage units, but also improve their operation capabilities, have contributed significantly to the construction of brand new wireless compact sensor units. form and low power. Wireless sensors have the ability to detect and measure various physical quantities, such as, e.g., temperature, humidity, light, pressure, sound, etc., as well as detecting the presence of certain objects. Together they form a dynamic data routing network, which has the ability to connect each node of the network to higher power wireless networks as well as to larger processing units of the received information. The so-called Wireless Sensor Networks (WSNs) often consist of a set of small, low-cost sensors that collect and transmit various critical data that they detect in their natural environment.

In recent years, the design of wireless sensor networks has become hugely important due to the ever-increasing number of commercial and military applications. The sensors are usually scattered in an area called the sensor field. Each of these sensors (or nodes) has the ability to collect data and then route it to the Base Station (sink) via a multi-hop path. The base station has the ability to communicate with the Task manager node via the Internet or via satellite. The design and communication architecture of a wireless sensor network depends on many factors, which are described in detail in the next section. The rapid reduction in the cost and size of sensor nodes has contributed substantially to the development of many dynamic applications related to, for example, medicine, industry, building security, and in this case the supply chain.

Summarizing, on the one hand, the developments in the technology of mobile communications and wireless sensor networks (WSN) and on the other hand, the development of modern technology of "IoT" can significantly improve the way of operation of transport and logistics companies. The knowledge provided through these solutions is what enables organizations to identify inefficiencies in real time, improving traffic and helping them build progressive plans to move toward innovation through optimal decision making. Below are some of the use cases for "IoT" in the supply chain within the limits of fleet management, warehouse limits, freight and last mile delivery.

Fleet Management

In terms of transport and supply chain, fleet management plays a crucial role in managing maintenance schedules, the day-to-day use of vehicles and order service routes. In order to maximize productivity and operational efficiency, fleet maintenance time must be minimized. At the same time, with the ability to safely monitor equipment and the environment in real time, field technicians can take action before problems arise. With the IoT, companies can remotely obtain information about their assets, enabling them to facilitate maintenance and eliminate unnecessary reactions and responses.

Storage Functions

Existing warehouse control systems will need to be "redefined" to manage data from sensors installed in the warehouse. Warehouses always serve as a vital hub in the flow of goods within a supply chain. In today's economic climate, they also act as a key source of competitive advantage for logistics providers who can offer fast, cost-effective and increasingly flexible storage processes to their customers. With thousands of different types and forms of goods stored in the middle warehouse today, every square meter of storage space must be used optimally to ensure that specific products can be retrieved, processed and delivered as quickly as possible. The result is a high-speed technology with a technological environment that is ideal for "IoT" applications.

Freight Transport

With hundreds of thousands of ocean, air and road assets, freight transport has great potential for IoT networks. Through the "IoT" the transport of goods will move beyond the "track and trace". Through the IoT, logistics providers will have clear visibility of freight traffic, meter by meter and second by second, as well as item-by-item monitoring to ensure that goods arrive in the right place on time and intact.

Application in Last Mile Delivery

With the last part of the delivery journey (the so-called "last mile") heavily dependent on work and as consumer demands become more complex and delivery points continue to multiply, logistics providers face new challenges. They need to find

new creative solutions for this important stage of the supply chain, cost-effective solutions that offer value to the end customer and operational efficiency to the logistics supplier. The "IoT" in the last mile can connect the logistics provider to the final recipient in exciting ways, as well as offer new dynamic business models.

METHODOLOGY

In this study we are dealing with the development of a Cloud platform for the Internet of Things (IOT) that can be used and will provide innovative solutions in different sectors (agriculture, demotic& home automation, smart cities etc) and in this case in logistics. The platform consists of two parts, the sensor network and the cloud server.

Sensor Network

Consisting of autonomous nodes with sensors used to monitor physical or environmental conditions, such as temperature, humidity, atmospheric pressure, sound, etc. The network is capable of and give information to the cloud, and conversely to receive information to perform a specific energy (mainly on / off) via an actuator.

Cloud Server

Cloud Server is the database that receives all the information from the sensor network, the information is stored, processed, and displayed in real time to a user from anywhere. Additionally, we are given the possibility to be able to control the remote sensor network.

The wireless sensor network consists of a central control node (gateway node) and one or multiple sensing node connected to each other via wireless antennas (apc220*)* in a star type topology.

The nodes (sensors) send periodic data every 15 minutes to the central node. The hub is connected to a router via Ethernet and data it collects, sends them to a database in the cloud. The nodes function implemented using microcontroller arduino* due to its low cost, ease of programming and the popular platform.

*It is a good choice for "experimental" level, for professional use can be replaced with other microcontrollers and sensors with the provided appropriate certification.

The Main Features of a Wireless Sensor Network Include:

- The energy consumption limits for nodes that use batteries
- Ability to deal node failures
- The mobility of nodes
- Communication failures
- The heterogeneity of nodes
- Escalation large scale growth
- Ability to withstand harsh environmental conditions
- Easy for Use

Each node is powered by rechargeable batteries (6600mAh) accompanied by a solar panel, making the autonomous system (Figure 2).

The system that is proposed is a complete autonomous control system based on microcontroller Arduino. For the implementation of the system microcontrollers and Arduino Mega Arduino Uno are being used, because of their low cost and low energy consumption (30-40 mA), characteristics that make them a good choice for use in the development of autonomous systems.

The Arduino Mega used as a central control node, where its role is to receive information from remote nodes with sensors that can be placed in various parts of the product. For the node with the sensors, the microcontroller Arduino uno is used, wherein the temperature sensors and air humidity were connected, and the rain sensor (Figure 3).

For the power of the microcontroller, rechargeable batteries 5000 mah Cordless from a photovoltaic panel (2 watts), were used, and in order for the safety of microcontroller was used a specialist charge controller. After testing of the supply system, the duration of the microcontroller autonomy with associated sensors was about 100 hours.

For communication between the microcontroller radio antennas were used (APC220) with maximum 1Km communication distance that fully covered the needs of the implementation system.

The central control node receives information from remote nodes via the radio antenna. Through a GSM board when there is a change in the environmental conditions may give notice remotely via a sms message. Programming became via AT command by incorporating the programming language C ++ of Arduino. Next was the addition of a static relay which serves as a switch, which can activate a specific computerized system. In programming bit microcontrollers, there were some difficulties mainly in finding libraries for individual components and sensors, but after reprogramming and appropriate configuration of the respective libraries' difficulties were resolved.

Based on the above technology and the proposed topology, the responsible managers of the command center are able through decision making to determine optimal directions and routes for drivers, to observe driver behaviors, to monitor goods in real time, as well as to locate possible failure of the vehicle from the predetermined or modified route.

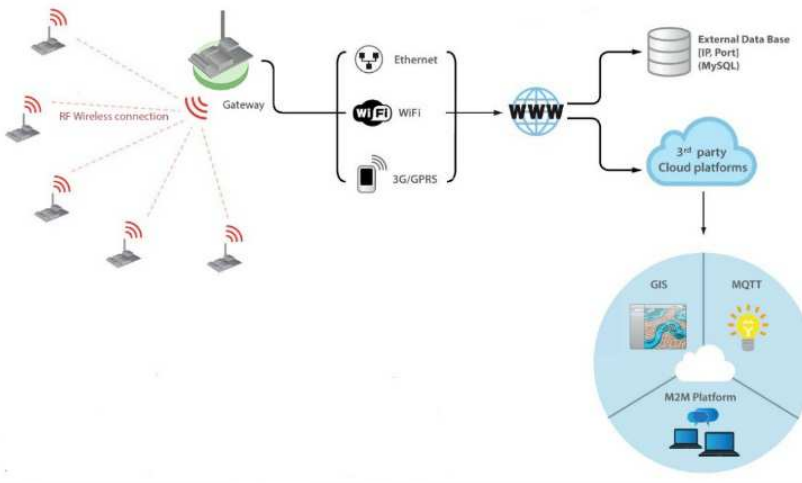

Figure 1: Proposed IoT Topology.

Figure 1: Arduino Microcontroller.

RESULTS

The technology solution consists of an Arduino node installed on each vehicle, the main components of each Arduino node are the temperature sensor, a GPS antenna, a 3Gantenna, using RFID or NFC technology, provide synchronized information and material flow in real time, operators are able to gather information on specified cargo at any time, instantaneously. With the help of these sensors, along with real-time locating systems, GPS tracking systems, and other information relaying tags, the objects are able to communicate with each other and disperse the information through the Internet in real time. Data is transferred into the cloud, and the devices can identify the pallet and not only share its position using GPS coordinates, but also bring in other data like weather conditions, traffic conditions, and driver-specific data (i.e., driving pattern, average speed).By tapping the data gathered by these technologies, detailed visibility of an item is provided all the way from the manufacturer to the retailer. Data gathered from GPS and RFID technologies not only allows supply chain professionals to automate shipping and delivery by exactly predicting the time of arrival; they can monitor important details like temperature control, which impact the quality of a product in-transit.

IoT Can Help Supply Chain Professionals

- Reduce asset loss. Know about product issues in time to find a solution.
- Save fuel costs. Optimize fleet routes by monitoring traffic conditions.
- Ensure temperature stability by monitoring the cold chain.
- Manage warehouse stock. Monitor inventory to reduce out-of-stock situations.
- Gain user insight. Embedded sensors provide visibility into customer behavior and product usage.

CONCLUSIONS

This Arduinovia IoT Technology that is suggested in this paper, and also with the support of a node with the necessary sensors provides information in real time about the status of products and the security of containers during transport worldwide. The breadth of application highlighted in this report underscores how IoT is impacting virtually every sector of the logistics industry and society.

The IoT through the WSNs promises to create a revolutionary, fully interconnected "smart" world, where relationships between objects, the environment and people become increasingly intricately linked. The perspective of the Internet of Things can fundamentally change the way people think. Supply chain management will continue to use these advanced technologies to improve the tracking of materials, shipments, stocks, orders, resources and health and safety best practices with the ultimate goal of maximizing revenue and proper decision making at all stages.

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