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BLE TO RS485: INDUSTRIAL GATEWAY

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Abstract: **These papers presents design and practical implications of smart industrial gateway which collects the data from the ble device and transfer it on Modbus RTU and Ethernet for monitoring the data remotely, most of the industry need the solution for data monitoring of multiple devices with less network traffic and minimal wiring, so this paper focused on this issue. Many industries use large mechanical machines to handle heavy loads and to operate multiple devices at the same time requiring wires connected to computers and equipment which increases wiring mixing and reduces power generation. To overcome this, wireless channels can be used instead of wires.**

Keywords — **BLE, Gateway, RTU, Ethernet, Power over Ethernet (POE)**

I. INTRODUCTION

There have been many advances and significant changes in the field of technology. The way we interact and interact with humans and other devices is changing and getting better day by day. With the rapid changes of technology in recent years, various low-power wireless technologies have been developed and widely used. There is a growing interest in using technology in various industries. Many industrial projects have been implemented in agriculture, food industry, environmental monitoring, security surveillance and others. In order to provide high-quality services to end users, it is necessary to create technical standards to clarify the details for the exchange, processing and communication of information between things. Success depends on standardization, interoperability, compatibility, reliability and effective operations. This paper presents the design and practical effects of blades on industrial entrances. A gateway is a piece of networking hardware or a piece of software used for a network that allows data to move from one network to another. Gateways communicate using multiple protocols to connect to multiple networks, which are different than routers or switches, and can operate at any level of transmission control protocol (TCP). Gateway is a combination of Bluetooth + Ethernet modules, which can communicate with Anyone using a BLE compatible device and transfer data to the server using an on-board Ethernet module. Basically the communication between the Bluetooth module and the Ethernet module is via UART. Their combination will

allow more accurate localization. We are able to communicate and send data back and forth. Using the internet without a gateway would not be useful for us. Ethernet cable is a common network cable used with wire networks. Ethernet cables connect devices such as PCs, routers, and switches to local area networks. These physical cables are limited by length and durability. If the network cable is too long or too short, it does not give a good network signal. These limitations are one of the reasons for good network signals. There are different types of Ethernet cables that are adapted to perform certain tasks in specific situations. Ethernet is a great technology to reduce operating costs. This is one of the reasons why it is benefiting wider industries than ever before. Relying on abundant products over Ethernet, the need for new standards is growing. Ethernet has gained access to many network applications around the world. . In recent years, with the rapid advancement of technology, various low-power wireless technologies have been developed and widely used.

II. EXISTING SYSTEM

Industries today carry more work and heavier loads than they did many years ago. All this was controlled by man himself and then the Industrial Revolution took place. The old traditional techniques were replaced by electronically controlled machines but they needed a lot of wires to control the basic functionality of the motors so this was a tedious task.

Now that wireless communication has been introduced, everything can be controlled wirelessly. Improved data communications lead to faster transfer of information, as wireless technology allows the user to communicate when you're rarely in touch - you don't need extra cables or adapters to access the office network. Wireless transmissions are more likely to be attacked by unauthorized users, so you should pay special attention to security.
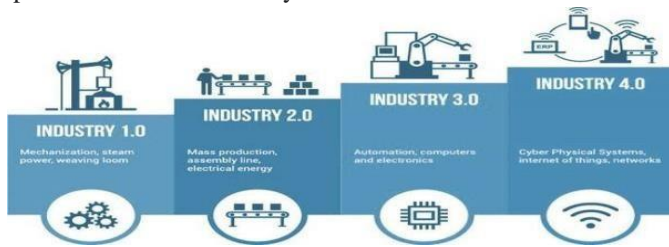

Fig.1. Industry Advancement

When Bluetooth exits the Wi-Fi gateway, the transfer information or communication takes place in a half-dual mode i.e. in one direction. The BLE to Wi-Fi gateway device makes it easier and less costly to cover an area with BLE and connect it to the cloud, making it beneficial for applications to do real-time remote monitoring or property tracking with less effort and manpower. Gateway BLE reads the ad The data in the beacon (such as bacon or Edistone) is sent to the custom format and MICTT server over Wi-Fi. Users can configure server credentials, Wi-Fi settings, data duration with a simple web UI. This makes it effective as a BLE for wireless adapters.

The Ble to Ethernet gateway is useful for two-way communication between a Bluetooth device with a host server. Wireless network security primarily protects the wireless network from unauthorized and malicious access attempts. In short, wireless network security is delivered via a wireless device (usually a wireless router / switch) that encrypts and secures all wireless communications by default. Although wireless network security is compromised, the hacker is not able to see traffic / packet content in transit. In addition, the wireless access control and prevention system also enables protection of the wireless network by alerting the wireless network administrator in case of security breach.

III. SYSTEM MODEL

The Ble to Ethernet module is useful for two-way communication between a Bluetooth device with a host server. The gateway device has its own blade that acts as a master and scans for nearby available blade equipment. The

master can connect to 7 slave devices and communicate with them simultaneously. The master installs a Ble network and acts as a bridge between the server and the device. The Bleu to Ethernet module is useful for two-way communication between a Bluetooth device with a host server. The gateway device has its own blade that acts as a master and scans for nearby available blade equipment. The master can connect to 7 slave devices and communicate with them simultaneously. The master installs a Ble network and acts as a bridge between the server and the device. After data transfer, the server sends a receipt to the device. The server updates the device connection status depending on whether the gateway device derive is connected. The same gateway also has the ability to communicate over the Modbus protocol with Rs 854 serial communication which is widely used in the industry for field bus communication. Providing a clever way for sensors to communicate with the server.
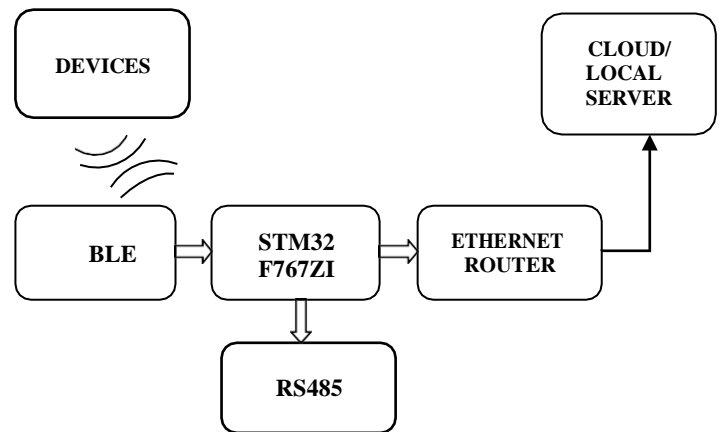

Fig.2 Block Diagram

This section presents the components and the pro-posed model. The hardware components used in the proposed system is below:-

- STM32 F767ZIMicrocontroller
- RS485
- BLE
- Power Over Ethernet

1] STM32 F767ZI: The STM32 board provides an affordable and flexible way for users to try out new concepts and build prototypes with the STM32 microcontroller, choosing from the various combinations of performance, power consumption and features. The ST connector which is an extension of Arduino Uno provides access to more peripherals to expand the functionality of the Nucleo open development platform

with a wide choice of specialized shields. This board does not require any separate probe as it integrates the ST-LINK/V2-1 debugger/programmer and it comes with the STM32 comprehensive software HAL library, together with various packaged software examples as well as direct access to the ARM mdeb online resource. It is supported by wide choice of integrated development environments (IDEs) including IAR, Kiel, ARM mbed and GCC-based IDEs. STM32 Nucleo development boards provide an affordable and flexible way for users to test solutions and build prototypes with any STM32 microcontroller line. The Arduino connectivity support and ST morph connectors make it easy to expand the functionality of the STM32 Nucleo open development platform with a wide range of specialized expansion boards to choose from. The STM32 board does not require separate probes as it integrates the ST-LINK/V2-1 debugger/programmer.

Specifications:

o STM32 microcontroller in LQFP144 package, flexible board power supply, 5V from ST-LINK/V2-1 USB VBUS
o External power sources of 3.3V & 7V-12V on ST.
o USB OTG or full speed device with Micro-AB connector (depending on STM32 support)
o IEEE-802.3-2002 compliant Ethernet connector (depending on STM32 support)
o 3 user LEDs, 2 push buttons, USER and RESET
o 32.768KHz LSE crystal oscillator, 216 MHz max CPU frequency
o VDD from 1.7 V to 3.6 V
o 512 KB SRAM, 2 MB Flash
o GPIOs (114) with external interrupt capability
o 12-bit ADCs with 24 channels, 12-bit DAC channels
o I2C, SPI , USART/UART
o General Purpose Timers (10), Advanced-control Timers , Basic Timers, Watchdog Timer
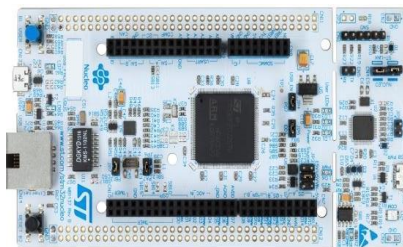

Fig.3.STM32F767ZI

2] RS485: RS485 is a serial data transmission standard widely used in industrial implementations. The Modbus protocol is commonly used when implementing RS485 communication. This differentiates RS485 from the RS232 protocol which communicates by transmitting with ASCII characters. One of the reasons that RS485 interfacing is employed in industrial settings is its ability to serve several devices attached to the same bus. This eliminates the need to have several interfaces available when querying multiple devices. You can do this by using a bus terminator, moving a switch or with a small resistor screwed onto a terminal. RS-485 allows multiple devices (up to 32) to communicate at half-duplex on a single pair of wires, plus a ground wire (more on that later), at distances up to 1200 meters (4000 feet). "Four-wire" networks have one master port with the transmitter connected to each of the "slave" receivers on one twisted pair.

3] BLE: BLE module BT680 Series modules use TC35680 Series SoCs. With an u.FL connector for external antenna, FCC, and other certifications, it allows faster time to market with reduced development cost. Ultra Long Bluetooth Range With a high performance antenna, +8 dBm TX power and CODED-PHY to improve receiver sensitivity, Bluetooth range for 125 Kbps data rate between 2 modules is measured at 3000 meters. Bluetooth range for 1Mbps data rate is 750 meters.

Table 1:BLE Specifications

Bluetooth version	5
SOC	TC35680FSG-002
MCU	Cortex M0 at 32 MHz
Memory RAM/ROM/Flash	240KB/144KB/128KB
HCL Commands	Yes
Standalone mode	Yes
Antenna	u.FL for external antenna
Operational temperature	-40oC to +85Oc
Evaluation Board	EV-BT680E
Price at 1K pcs	$4.25

4] Power Over Ethernet: As the name suggests, providing electric power through Ethernet cables is called Poe. We all know that Ethernet cables are used for data transfer and network connectivity but you know that most of the time we do not use all the connecting lines present in Ethernet. Cable For example, consider the Ethernet cable shown in the figure below, it has 8 lines but only four of them are commonly used

for data exchange (orange, orange-white, green and green-white) the remaining four lines remain constant. So it is possible to exchange data even after we remove these passive lines at both ends, so low-end Ethernet cables have only four lines instead of eight. So idle four lines can be used for power transfer.
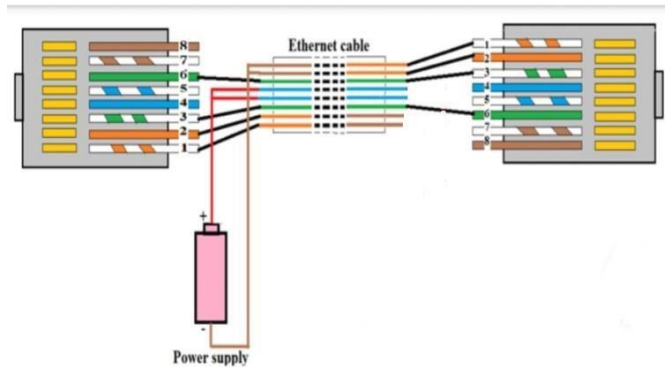

Fig 4.Power over Ethernet (POE)

Benefits Of Poe

Any device which connects to a network via an Ethernet cable – VoIP telephones, wireless routers, IP security cameras – needs only one cable connection to power and operate if you use Poe. This makes installation simpler and less expensive, which helps when it comes to scaling up networks by adding new connections and devices. Poe connections also offer greater flexibility in terms of where you can locate a device, as you are not dependent on mains plug sockets or other power sources. This also offers benefits in terms of reliability and safety – power comes from a single, stable source, rather than a variety of different adapters in different sockets. There is therefore less risk of power outages, overload and potential damage to equipment.
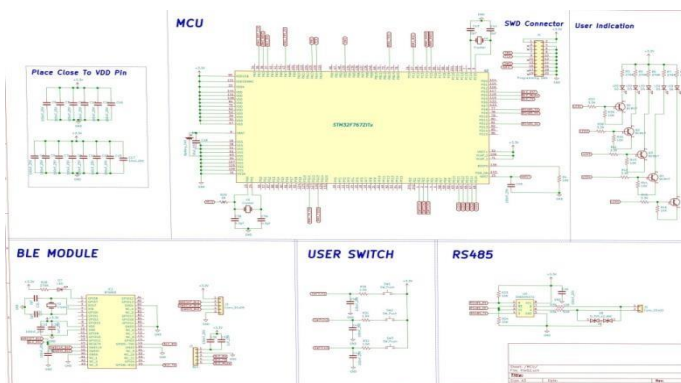
IV. RESULTS

STM32CubeIDE is an advanced C/C++ development platform with peripheral configuration, code generation, code compilation, and debug features for STM32 microcontrollers and microprocessors. STM32CubeIDE is nonetheless a highly symbolic initiative because it provides a free and uniquely feature-rich environment to enthusiasts and professionals, thanks to the integration of tools like STM32CubeMX that will enable a more efficient workflow. STM32CubeIDE is available for Windows, macOS, and Linux, with a version specific for Debian/Ubuntu, Fedora and a more general installer for the other distributions.Causal Productions wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template. To see the list of contributors, please refer to the top of file IEEETran.cls in the IEEE LaTeX distribution.
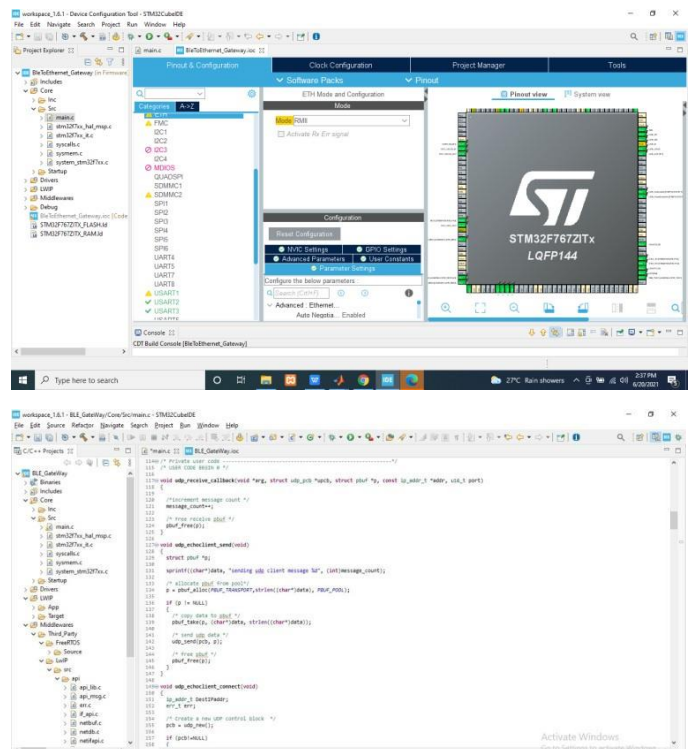
The source code is basically used as an input to the process of creating an executable program (i.e., compiled, Debugged or interpreted). It is also used as a way for people to communicate with algorithms. The figure shows the executable source code for Smart industrial Gateway.

IV. APPLICATIONS

- It will help to control nearby appliances with the help of BLE technology.
- This can be used in industries to operate many machines simultaneously by sitting at one place.
- No requirement of any internet connection to operate appliances.
- It can also be used in real time monitoring system.
- Social alert
- Health and fitness

V. CONCLUSION

Thus the article explains the design and practical consequences of blades on industrial gateways that collect data from blade devices and transfer data to Modbus RTU and Ethernet for remote monitoring, most industries require solutions for low network traffic and data monitoring of at least several devices with less network traffic and minimal wiring. Old traditional techniques were replaced by electronically controlled machines but they needed lot of wires to control motors basic functionality so this became tedious task. The system is very much helpful for interacting and communicating with humans and other devices. Now internet and wireless communication has been introduced, everything can be controlled wirelessly. This saves you a lot of time and allows you to do more in the same amount of time. In specific cases, you will need fewer people with the help of a remote control, which will positively benefit your cash flow. The safety is a core issue.

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