LORA BASED MICROCONTROLLER DEVELOPMENT MODULE FOR FACTORY MONITORING SYSTEM

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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ABSTRACT

Lora based microcontroller development module for factory monitoring system Large scale factory monitoring and control system such as SCADA require a very long cable to complete the system. This is a standard for industries for many years. New technology adopts wireless technology to transfer the data from one point to another. Some may suggest wifi but the range is limited and may require many gateway or router point inside a huge factory. Furthermore, many microcontroller hardware has less wireless range as compared to the range for mobile phone or computer wifi range. The typical range of 5-10 meters for ESP8266, ESP32 and several microcontroller with builtin wifi limits the feasibility of using the wifi for a huge factory warehouse that needs to be interconnected. Thus this project offers LoRa development module built with Atmega microcontroller to interface with Arduino IDE. This module will be a product that can be commercialized for industry application.

ABSTRAK

Modul pembangunan mikropengawal berasaskan Lora untuk sistem pemantauan kilangSistem pemantauan dan kawalan kilang berskala besar seperti SCADA memerlukan kabel yang sangat panjang untuk melengkapkan sistem. Ini adalah piawaian untuk industri selama bertahun-tahun. Teknologi baharu menggunakan teknologi tanpa wayar untuk memindahkan data dari satu titik ke titik lain. Sesetengah mungkin mencadangkan wifi tetapi julatnya terhad dan mungkin memerlukan banyak pintu masuk atau titik penghala di dalam kilang yang besar. Tambahan pula, kebanyakan perkakasan mikropengawal mempunyai julat tanpa wayar yang kurang berbanding untuk julat wifi telefon mudah alih atau komputer. Julat tipikal 5-10 meter untuk ESP8266, ESP32 dan beberapa mikropengawal dengan wifi terbina menghad kemungkinan menggunakan wifi untuk gudang kilang yang besar yang perlu disambungkan. Oleh itu projek ini menawarkan modul pembangunan LoRa yang dibina dengan mikropengawal Atmega dengan Arduino IDE. Modul ini akan menjadi produk yang boleh dikomersialkan untuk aplikasi industri..

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

IOT	:	Internet of Things
LORA	:	Long Range low power
KPIs	:	Key performance indicators
GSM	:	The Global System for Mobile communications
GPRS	:	General Packet Radio Service
IOT	:	internet of things
WSN	:	Wireless Sensor Network
WAN	:	wide area network
LPWAN	:	Low-power WAN
CSS	:	chirp spread spectrum
BLE	:	Bluetooth Low Energy
Wi-Fi	:	Wireless Fidelity
PWM	:	pulse width modulation
MIPS	:	Multi-directional Impact Protection System
RISC	:	reduced instruction set computer
AFC	:	average frustrated chump
RSSI	:	Received Signal Strength Indicator
CRC	:	Computer Resource Control

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

This chapter focuses on the project's background and problem statement, followed by the objectives and scope that have been determined. Finally, the proposed solution will be reviewed.

1.1 Background

Process optimization, power consumption reduction, and reliable information gathering regarding device failures are all priorities in the automation and industrial control sector. It's great to be able to predict when machinery will need to be shut down for scheduled maintenance. Retrieving such information (especially for machinery) is done through continuous motorization of essential parameters such as - but not limited to - vibration, current consumption and temperature. Current monitoring options include wired sensors and wired equipment, which have the drawbacks of being costly

to install initially and requiring regular system maintenance. With the most recent advancements in wireless sensor technology, network equipment has grown less expensive and more widely available WSN becomes more practical and simpler as it consumes less energy to make use of on a huge basis Wireless systems have a number of advantages Compared to wired systems, the following benefits are available[1]:

- cheap cost,
- ideal for monitoring hazardous areas,
- more flexibility and adaptability,
- smoother system growth

All of the advantages provided by wireless networks have resulted in a new industry paradigm, called Industry 4.0. Some of the advantages brought by Industry 4.0 and the use of wireless technology in industrial control systems are:

improved flexibility, high data processing speeds, greater factory efficiency, improved end product quality with reduced scrap and lost material [2].

According to several scholars, that Industry 4.0 is strongly related to the IoT (Internet of Things) paradigm that highlights the need of linking all gadgets in order to improve the relationship between IT (Internet Technology) and OT (Operations Technology), as stated in [3] and [4].

Naturally, there are various hardware and software criteria for wireless monitoring systems that must be followed when using such technologies in industrial settings in order to optimize the advantages without incurring additional costs[4] :

- robust radio technology,
- reduced cost,
- low-power central processing unit,
- extended capabilities for sensors interfacing,
- extended battery life,
- reduced dimensions,
- enhanced modularity.

1.2 Problem Statement

Big data and manufacturing go hand-in-hand, as the vast amounts of data that manufacturers collect can be used to improve their operations. As manufacturers become more focused on extracting valuable insight from data, their businesses are poised to benefit from the increasing volume of data. The true value of manufacturing data can only be accessed through an infrastructure that enables manufacturers to collect and store real-time data. By collecting data, manufacturers can improve visibility into their operations. This allows them to make better decisions and produce more effectively. To ensure that they are fulfilling production targets, operators might employ machine interfaces that display machine statuses, part counts, or other KPIs. Plant managers may utilize visual production dashboards to monitor which operators want assistance and which equipment is offline. Engineers can utilize aggregated production data to identify bottlenecks and adjust operations as needed.

This is all part of the manufacturer's quest to progress. As businesses gain "data maturity," they will be able to create increasingly more complex use cases with their data, going beyond simple data gathering and visibility.

Most of the methods available at present for data transfer need many things that take up a large space or a high cost and even energy consumption is relatively large for what these devices do. This may contain some problems and errors in accuracy and speed. It also needs wires that are often at least 100 meters long. The wires have many problems, especially if there is a malfunction, it is difficult to track the malfunction in the wire network during the factory and this may affect the work of the factory in that period. In addition to the amount of energy wasted, these devices and wires.

Using loRa and GSM, this will enable data transfer without the need to extend wires, consume significant energy and occupy a large space. In addition, it has a speed and a high accuracy in data transmission. The data is collected on IOT platform so that it can be accessed anywhere, at any time and the required information extracted.

1.3 Objective

I. To design a prototype for LoRa system using Atmega328 microcontroller, collects data from the sensor by RS485, and sends it using GSM .

II. To develop an IOT based solution, it works to monitor data in factories and then collect it on a specific platform.

III. To analyze the data collected on the platform.