Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF RADIO FREQUENCY IDENTIFICATION TRACKING SYSTEM IN INDUSTRY WAREHOUSE USING DRONE

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

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DEVELOPMENT OF RADIO FREQUENCY IDENTIFICATION TRACKING SYSTEM IN INDUSTRY WAREHOUSE USING DRONE

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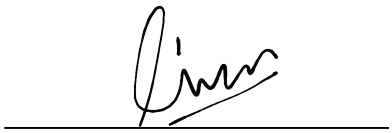

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ABSTRACT

Due any industry's warehouse or sites rely on a wide range of tools, keeping track of their availability is a difficult task. To find materials in large industry and warehouse takes more time and energy. One of the most promising technologies for enabling new smart applications in the context of the internet of things is radio frequency identification (RFID) (IoT). However, from an electromagnetic standpoint, the performance of RFID tags is often linked to the context, thus the selection of the most appropriate tag for the specific application becomes the most important factor. This study presents an affordable yet accurate characterisation approach for the performance evaluation of RFID tags, which is then verified on the IoT-related application of RFID-based interaction with buildings. The widespread use of RFID technology has substantially increased customer convenience in a variety of applications, including smart tags. The systems, on the other hand, were designed using a active RFID system that requires a backup power source to operate. The planning and development of a passive RFID system is the subject of this study. The developed technology is utilised to manage a technology over a specific distance automatically. A prototype of a passive RFID system built in a highly automated environment. The application is being displayed for performance testing. The main component for this project was Radio Frequency Identification tracking system, Arduino, Ultrasonic sensor, and Drone. The RFID is attached to the drone. Drone were move by using ballistic flight which is a flight path on a screen and the drone will automatically fly along specified area. Signal were obtained by RFID sensors were transmitted wireless to microcontroller and input data were given. Arduino microcontroller were programmed to RFID to detect the tag and the drone will moved to the direction. As the safety propose of the system, ultrasonic sensors were used in order to detect and avoided obstacles. An analysis of test the accuracy and efficiency of RFID was done by comparing its distance and delay taken to transmit and receive data.

ABSTRAK

Oleh kerana gudang atau tapak industri bergantung pada pelbagai alat, menjejaki ketersediaannya adalah tugas yang sukar. Untuk mencari bahan dalam industri besar dan gudang memerlukan lebih banyak masa dan tenaga. Salah satu teknologi yang paling menjanjikan untuk mengaktifkan aplikasi pintar baru dalam konteks internet adalah pengenalpastian frekuensi radio (RFID) (IoT). Walau bagaimanapun, dari sudut pandang elektromagnetik, prestasi tag RFID sering dikaitkan dengan konteks, oleh itu pemilihan tag yang paling sesuai untuk aplikasi tertentu menjadi faktor yang paling penting. Kajian ini menyajikan pendekatan pencirian yang berpatutan namun tepat untuk penilaian prestasi tag RFID, yang kemudian disahkan pada aplikasi interaksi berasaskan RFT dengan bangunan yang berkaitan dengan IoT. Penggunaan teknologi RFID yang meluas telah meningkatkan kemudahan pelanggan dalam pelbagai aplikasi, termasuk tag pintar. Sistem, di sisi lain, dirancang menggunakan sistem RFID aktif yang memerlukan sumber kuasa sandaran untuk beroperasi. Perancangan dan pengembangan sistem RFID pasif adalah subjek kajian ini. Teknologi yang dikembangkan digunakan untuk mengurus teknologi pada jarak tertentu secara automatik. Prototaip sistem RFID pasif yang dibina dalam persekitaran yang sangat automatik. Aplikasi ini dipaparkan untuk ujian prestasi. Komponen utama untuk projek ini adalah sistem pengesanan Frekuensi Radio, Arduino, sensor Ultrasonik, dan Drone. RFID dilekatkan pada drone. Drone bergerak dengan menggunakan penerbangan balistik yang merupakan jalur penerbangan di layar dan drone secara automatik akan terbang di sepanjang kawasan yang ditentukan. Isyarat diperolehi oleh sensor RFID yang dihantar tanpa wayar ke mikrokontroler dan data input diberikan. Mikrokontroler Arduino diprogramkan ke RFID untuk mengesan tag dan drone akan bergerak ke arah. Sebagai cadangan keselamatan sistem, sensor ultrasonik digunakan untuk mengesan dan menghindari rintangan. Analisis menguji ketepatan dan kecekapan RFID dilakukan dengan membandingkan jarak dan kelewatan yang diambil untuk menghantar dan menerima data.

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LIST OF SYMBOLS

mA	-	Milli Ampere
S	-	Second
Kg	-	Kilogram
A	-	Ampere
V	-	Voltage
C	-	Velocity of Ultrasonic
T	-	Transmitter
L	-	Length

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RAM	-	Random access memory
ROM	-	Read only memory
DSP	-	Digital signal processor
RFID	-	Radio Frequency Identification
IDE	-	Integrated development environment
LED	-	Light emitting diode
GUI	-	Graphical user interface
IR	-	Infrared radiation
CI	-	Continuous integration
RF	-	Radio Frequency
AC	-	Alternating Current
DC	-	Direct Current
IC	-	Integrated circuit
LIPO	-	Lithium Polymer Battery
MCU	-	Microcontroller Unit
UHF	-	Ultra-High Frequency
SPI	-	Serial Peripheral Interface
MISO	-	Master In Slave Out
MOSI	-	Master Out Slave In
SCK	-	Serial Clock

CHAPTER 1

INTRODUCTION

1.1 Project background

This project is to development of Radio Frequency Identification Tracking System in industries warehouse applications using ultra-sonic sensor and Arduino. Radio Frequency Identification Tracking System has been become worldwide wireless technology innovation developed uses electromagnetic fields to recognise and monitor tags affixed to items automatically for material or human to manage their movements and provide good access and effective environment. RFID is a tiny radio transponder, a radio receiver, and a transmitter make up the system. This RFID is the tag transmits digital data, usually an identifying inventory number, back to the reader when it is triggered by an electromagnetic interrogation pulse from a nearby RFID reader device. A drone is a plane that does not have a human pilot on board. The Drone is operating automatically or under the control of a human operator at a distance which is remotely piloted aircraft. RFID is attached to the drone to sense and detect things around the warehouse. Signals were obtained by RFID sensors were transmitted wirelessly to the microcontroller and send data signal. Arduino microcontroller Drone will be programmed to fly and move to certain direction. Arduino microcontroller will be programmed with RFID to detect, receives and transmitted signal. As a safety propose of the system, ultrasonic sensor has been added as to detect and avoid obstacles. This innovation delivers quicker, smoother, and better control. In this project, Arduino has been used as a microcontroller for this project. The Arduino software is program to control and fulfil requirement of the system has been designed in this project.

1.2 Problem Statement

Since there were many new inventions in assistive technology that being helpful to industries and worldwide, still there are some problems with those inventions. Manually searching is an inability to find and allocate items or materials in short time. Some inventions use more time and energy to do such works such as Automated Guided Vehicle, barcode, etc. Some people feel uncomfortable with these systems where excessive movement brings tiredness to the person.

Managing the availability of assets in industries that rely on a wide range of instruments is a difficult task. To find materials in large industry takes more time and energy. Using drones, an RFID tracking system will be used to track which tools have been seized, which employees have stolen resources, and which resources have not been returned to the tool crib, depending on the amount of intricacy. Also, can be used in any industry warehouse. This system will use drone, Arduino, and several suitable sensors to track the location of material that will save cost, time, and energy consumption to find material. The system will be tested and analysed in term of accuracy of RFID signal and time consumption for material detection.[1]

Thus, factors that said above have brought up development Radio Frequency Identification Tracking system. This project was design of RFID with a drone that fly automatically or control by human which is piloted aircraft that helps finding and tracking items or materials easily. In this project there are several factors that was considered such as accuracy, efficiency, and safety. RFID drone system acquires a suitable speed to ensure the safety of the environment. RFID system needs an accurate wireless connection to transmitting data from transmitter to receiver and it allows the RFID sensor to detect and sending signal to alert. An ultrasonic sensor has been used to detect the obstacles nearby drone to ensure this system is more safety and convenient to use.

1.3 Project Objective

In this study, there are few objectives that will archive.

I. To design hardware of tracking System using RFID and Drone.
II. To develop an algorithm software program of tracking System by using Arduino.
III. To test and analyze the performance of the tracking system in term of accuracy the RFID used.

1.4 Work Scope

In order to archive the objective of the project, there was several important criteria that need to consider:

I. Radio Frequency Identification System is design to track and detect items or resources.
II. Drone will be applied to find material at any specific places in a short time and applicable to cover small to medium area.
III. Arduino UNO will be applied for software system.
IV. Proteus and Fritzing software will be applied to simulate circuit.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This section discusses and summaries overall Radio Frequency Identification Tracking system and drone concept and theory of the project. This chapter's main proposal was explained past research and existing research. This chapter discussed the theory and concept used to solve this project's problem. Journals, articles, and case studies are the main sources of information. These sources have been selected based on the project scope similarity.

2.2 Review of Current Situation

Based on the industries environments, manually searching down goods or assets on project sites is usually more difficult than purchasing a replacement, but replacing those products is usually prohibitively expensive. Kennedy Wire Rope and Sling (KWRS) provides construction organisations with a wide selection of wire rope, rigging hardware, slings, and other lifting equipment. Due to the loss of equipment on their hectic and dangerous building sites, one client contacted KWRS about the regular reordering. KWRS opted to build a solution for preventing loss on these locations because it already provides a variety of post-sale services, such as equipment inspection, repair, testing, certificate storage, and even safety courses. All equipment was supplied with very tough RFID tags from the first client, and equipment certificates and data were uploaded online for clients to work out during interrogation. The technology is now used for equipment planning and asset allocation in addition to loss prevention and inventory tracking. This solution is ready to be implemented at other customer locations throughout the world due to the amount of money saved after implementation.[2]

2.3 Theory

2.3.1 Microcontroller Devices

A microcontroller is a miniature computer that is built into a single integrated circuit. A microcontroller, together with peripherals with memory and configurable input/output, contains one or more CPUs (processor cores). Still frequently included on the chip is memory program which in form of ferroelectric, RAM, NOR flash, or ROM. Microcontroller were created for embedded systems expect for microprocessors used for the laptop or any general-purpose implement made up of various discrete chips [3]. Microcontrollers has been used in product and devices automation control. Through limiting the size and cost differenced using separate microprocessor. The memory, input, output, and digital monitoring yet more price-effective devices and methods.

Comprehensive mixed signals are being used which really integrate to controlling non-digital electronic systems requires analogue components. Microcontrollers were famous and economically means of collecting, detecting, and acting on the physical world on the internet of things as edge devices. Several microcontrollers could use four-bit words or even works at ramps up to 4kHz for low power consumption. They typically can process functionality though waiting for press button or other interrupt, to create most of them ideal for long-lasting applications of batteries. Those certain microcontrollers may fulfil performance-critical roles in which they can act similar DSP, with greater clock speeds and larger power consumption. There were many types of microcontrollers in this current are such as Arduino, PIC, Raspberry PI and more.

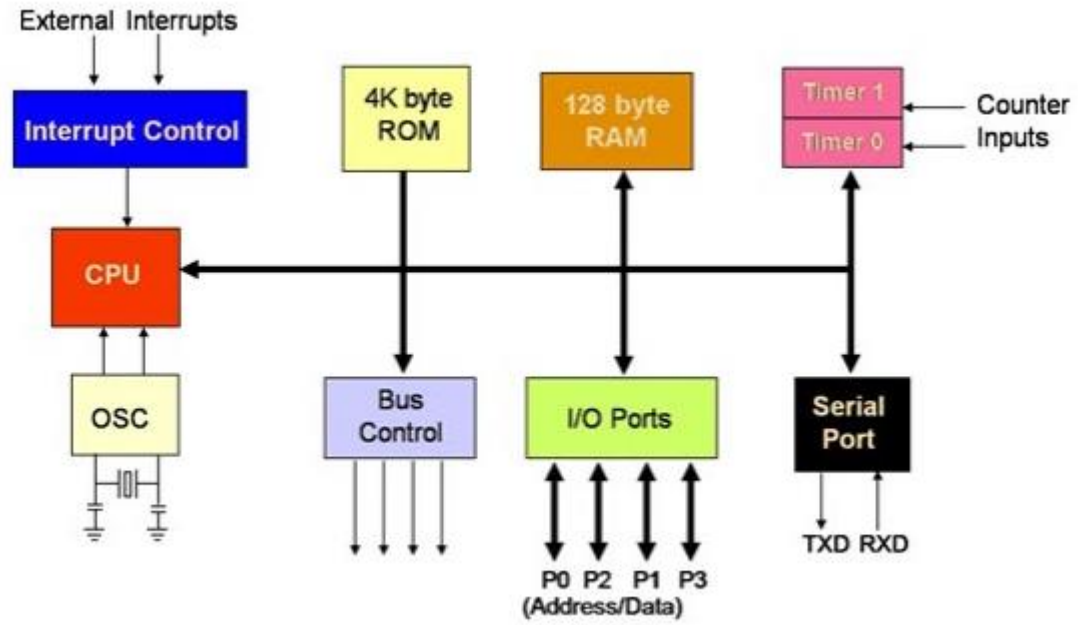

Figure 2.1: Block Diagram of Microcontroller

2.3.1.1 Arduino

Open-source device Arduino were used to develop projects for electrical appliances. Arduino comes in the form of a programmable physical circuit board and software, or even computer-operated IDE which used to compile and transfer computer coding to the circuit board. Arduino marketplace has been famous among people who just beginning with it for a good reason, electrical products. Unlike others Arduino does not require a separate hardware to upload new coding into the board and able to apply a USB cable. In addition, The Arduino IDE employs a very basic C++ version, which makes learning to code much easier.

There are many Arduino board varieties that can be used for various purposes. The one of the most famous Arduino family's boards and great choice for beginners is UNO. Arduino is a hardware and software platform for anyone interested in creating interactive objects or surroundings. Arduino able cooperate with your smartphone or TV with buttons, LEDs, the internet. Combined with this flexibility, Arduino is free, and Because hardware boards are inexpensive, software, and even software and hardware are simple to understand, a big user group has contributed code and approved instructions for an Arduino-based project. [4] There are many types of Arduinos such as Arduino Mini, Arduino Pro, Arduino UNO, Leonardo, Arduino MEGA, Arduino Due Arduino MEGA were commonly used by everyone.

.

2.3.1.2. Arduino UNO

Arduino UNO is well known at first choice since it is easy and convenient. It also includes with 14 digital pins for input / output (including 6 for PWM outputs), a USB linking, a power jack, a reset button and much more. It includes all you need to back up the microcontroller by simply connecting it to USB cable laptop or power it to get started battery or analog to digital converter supplies.

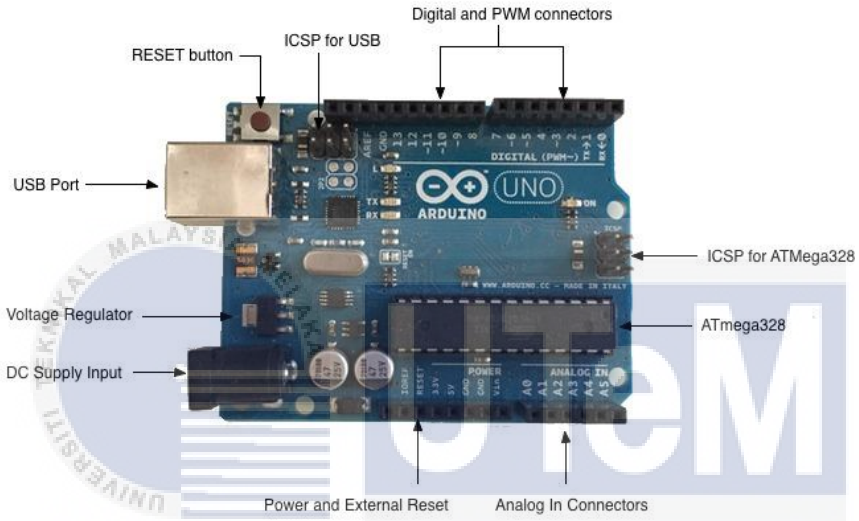

Figure 2.2: Labelled Diagram of Arduino UNO

2.3.1.3 Wi-Fi Node MCU (ESP8266)

The ESP8266 Wi-Fi Module is a self-contained SOC with an integrated TCP/IP protocol stack that allows any microcontroller to connect to your Wi-Fi network. This module can host an application or offload all Wi-Fi networking tasks to a different CPU. The ESP8266 Wi-Fi Module is a self-contained system on chip (SOC) with an integrated TCP/IP protocol stack that lets any microcontroller connect to your Wi-Fi network. This module has enough processing and storage capacity on board to allow it to be connected to sensors and other application-specific devices via its GPIOs with minimal development and load during runtime. [5]

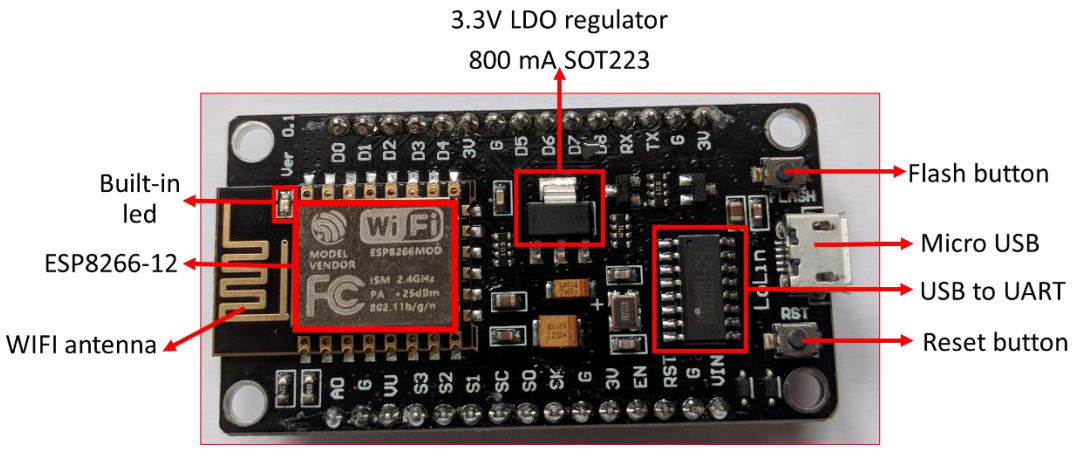

Figure 2.3: Labelled Diagram of ESP8266

2.3.1.4 Comparison of Wi-Fi Node MCU

Table 2.1 shows comparison between ESP8266 and show the characteristics which is used to choose the suitable MCU for Radio Frequency Identification Tracking system.