Faculty of Electrical and Electronic Engineering Technology

Development of IoT-Based Smart Pet Feeder Powered by Solar PV

NUR AINAA SAFFA BINTI KHAIRIAL ANUAR

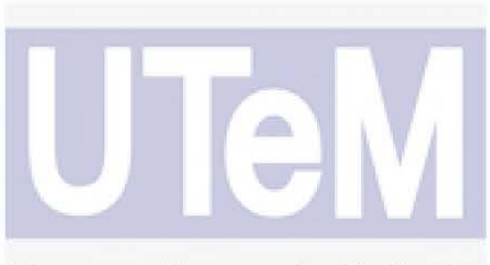
Bachelor of Electrical Engineering Technology with Honours

2021

Development of IoT-Based Smart Pet Feeder Powered by Solar PV

NUR AINAA SAFFA BINTI KHAIRIAL ANUAR

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology with Honours



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FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

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I declare that this project report entitled "Development of IoT -Based Smart Pet Feeder Powered by Solar PV" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

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DEDICATION

This thesis is dedicated to my loved ones who have meant so much to me. First and foremost, to my parents, who never quit to support me in a variety of ways.

For my father, who has always been there for me in big and small ways.

My mother, who has supported me throughout my studies.

Then there was my wonderful academic adviser, who helped me stay on track and also taught us how to persevere in life. May Allah bestow upon him.

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ABSTRACT

Technology is one of the most positive feedback for enhancing the quality of monitoring systems. Since the invention of the Internet of Things (IoT) into human lifestyles, world have developed a wide range of smart services based on IoT. There are some problems encountered in managing regular pet feeding. Among these problems it is the difficulty of getting the pet care nutrient in their health.Sometime, owners are not available at home because of their work.However, not every pet are good in taking care of diet. One of the best health concerns of pet is overeating to prevent obesity.Therefore, this paper introduces to develop smart pet feeder system to help feeding dry food diet to pet such as cat and dogs.The objectives of this project is to develop smart pet feeder wih Internet of Things (IoT), to develop a device that can automatically feed pets without the owner's presence using smart phone,to raise their pet in healthy life with complete nutrient needed and to design the project with solar powered.This smart pet feeder used weight sensor and WiFi module to control input and output of the system.The used of Wi-Fi module via Blynk Mobile app is to trigger a measure of dry food and for setting time in output.Solar energy is for powered system.This project is easy to use and monitoring a pet, other word this project is user-friendly as it introduced the best improvement to smart pet feeder system besides save energy.

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ABSTRAK

Teknologi adalah salah satu maklum balas yang paling positif untuk meningkatkan kualiti sistem pemantauan. Sejak penemuan Internet of Things (IoT) ke dalam gaya hidup manusia,dunia telah mengembangkan pelbagai perkhidmatan pintar berdasarkan IoT.Terdapat beberapa masalah yang dihadapi dalam menguruskan pemberian makanan haiwan kesayangan secara berkala.Antara masalah ini adalah kesukaran mengawal nutrisi penjagaan haiwan kesayangan dalam kesihatan mereka. Kadang-kadang, penjaga tidak ada di rumah kerana bekerja. Walau bagaimanapun, tidak setiap haiwan peliharaan pandai mengurus diet. Salah satu yang terbaik masalah kesihatan haiwan peliharaan ialah makan berlebihan untuk mencegah kegemukan.Oleh itu, laporan ini memperkenalkan untuk mengembangkan sistem pintar pemakanan haiwan peliharaan untuk membantu memberi makanan kering kepada haiwan kesayangan seperti kucing dan anjing. Objektif projek ini adalah untuk mengembangkan penyuap haiwan peliharaan dengan Internet of Things (IoT), untuk mengembangkan peranti yang dapat memberi makan haiwan peliharaan secara automatik tanpa kehadiran pemilik dengan menggunakan telefon pintar, untuk membesarkan haiwan kesayangan mereka dalam kehidupan yang sihat dengan nutrien lengkap yang diperlukan dan merancang projek dengan tenaga suria. Pengumpan haiwan peliharaan pintar ini menggunakan sensor berat,modul WiFi untuk mengawal input dan output sistem. Penggunaan modul Wi-Fi melalui aplikasi *Blynk* adalah untuk mencetuskan ukuran makanan kering dan untuk menetapkan masa dalam output.Tenaga suria adalah untuk bekalan kuasa. Projek ini mudah digunakan dan memantau haiwan kesayangan, dengan kata lain projek ini mesra pengguna kerana memperkenalkan penambahbaikan terbaik untuk sistem pintar pemberi makanan haiwan selain menjimatkan tenaga.

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LIST OF SYMBOLS

^{o}C	-	Temperature
%	-	Percentage

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LIST OF ABBREVIATIONS

V	-	Voltage
IoT	-	Internet of Things
PV	-	Photovoltaics
MQTT	-	MQ Telemetry Transport
GPIO	-	General-purpose input/output
LPWAN	-	Low Power Wide Area (LPWA) network
EREV	-	Extended Range Electric Vehicle
Ah	-	Amp-hours
Wh	-	Watt-hour
Amps	-	Ampere
SRAM	-	Static random access memory
RPM	-	Revolutions per minute
g	-	Grams
I	-	Current
P	-	Power
DC	-	Direct Current

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CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, we live in a technologically driven society, and technology is an integral component of every individual's everyday existence. Furthermore, technology is employed in our daily lives as an essential tool and machine to make life simpler by simplifying human chores and developing toward a developed society. Everything used to be done manually in ancient times, such as maintaining a plant, feeding a pet, travelling to the library to locate a reference, shopping at the supermarket, and asking people on the street for directions. Everything is now at your discretion. You can water plants by creating a smart system to monitor them using the Internet of Things (IoT), creating a smart pet feeder system using the Internet of Things (IoT), using a search engine to find references, and installing mobile applications to buy groceries such as Food Panda and finding directions using Waze.

The Internet of Things (IoT) is a common trend among consumers to utilise and construct smart digital systems. This enables users to oversee their work from a remote location, eliminating the requirement for on-site monitoring and inspection. The Internet of Things (IoT) is a new technological concept that includes a worldwide network of interconnected devices. Aside from that, industries have been paying serious attention to the IoT as a critical future technology. Monitoring and control systems are one example of an IoT application. This programme collects data on equipment performance, energy usage, and environmental factors, enabling managers and automated controllers to track performance in real time from any location and at any time. [1]

Our country is presently undergoing a fourth-industry revolution (Industry 4.0). By improving real-time connection, data collection, and analytics capabilities, the Internet of Things (IoT) transforms traditional business into a digital paradigm. Since the early 2010s, when IoT initially gained steam, the home appliance business has been a pioneer in incorporating cutting-edge technologies like IoT and the Cloud. With the advent of the Business 4.0 era, the home appliance industry has embraced technologies such as IoT and

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big data, which enable the collection of incremental data from consumers and smart devices. [2]

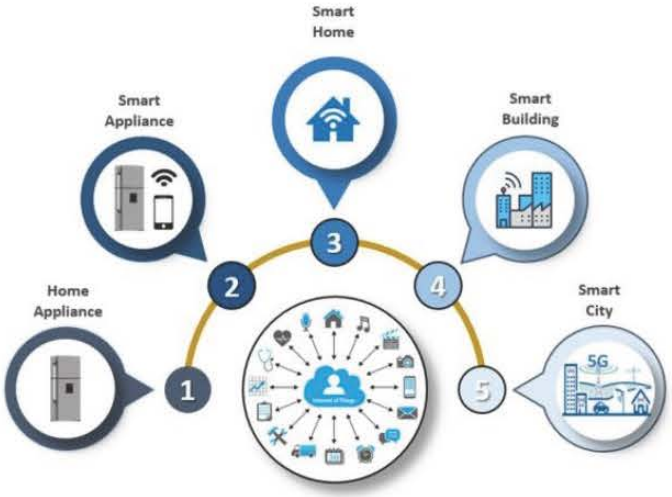

Figure 1.1 IoT enabled portfolio toward digital transformation

Source: [2]

1.2 Problem Statement

Pets can help us cope with loneliness and depression by providing companionship. Pet care should be enjoyable and not taxing. All pet must be cared, and the owner must be present to do so.

However, it is completely obvious that pet care is a burden for pet owners. A certain pet must be cared for, and the owner must be available to do it. Pet owners, on the other hand, cannot leave their pets alone .In order to rectify this problem, the *Blynk* platform was introduced in this project for connecting to the development board and providing a server or collecting IoT feeding data. By using IoT, the project can manage time for feeding the cat.

Other than that, some pets will certainly eat some type of food. Therefore, to solve it, a system that can be prepared first using chosen food and can instantly feed without the owner's presence is required to ensure the pet's health.

In addition, some pets are unable to limit their diet and will eat as long as food is available. For fully monitor the pet's diet it is essential for the owner to ensure that the pet is in healthy living. Therefore, this project is designed by using weight sensor for the scale. It

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can be used to monitor the amount of food feed to the pet at each meal in order to be cautious and reduce the risk of illness[3]

Additionally, pet owners will also be upset if there is a blackout when leaving the house for a long time. So this project is designed using a solar system. The use of solar energy can not only facilitate if the electricity is cut off, but can also save on electricity bills.

According to that, in this project the system functions in two ways. The first is to feed the pet. After eating the pet, the system will stop interacting for a short period of time to ensure that the pet does not eat too much.

1.3 Project Objective

At the end of this project, there are a few necessary objectives that need to be achieved. For the project title, "Development of IoT based Smart Pet Feeder Powered by Solar PV", this project is able to:

a) To implement the Internet of Things (IoT) for a smart pet feeder system
b) To develop a device that can automatically feed pets without the owner's presence by using a microcontroller-based system
c) To provide their pet with the necessary nutrition for a healthy life.
d) To design the solar powered for feeder system.

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1.4 Scope of Project

To avoid any uncertainty about this project due to some limitations and constraints, the scope of the project are defined as follows:

a) The IoT that was developed for smart pet feeders covers the monitoring system in technology.
b) Solar powered supply with battery charging and controller system.
c) Investigation of powered supply that support from solar, time setting for pet feed and weighing measurement were considered in analytical models.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In today's modern society, the world has seen technological advancements grow in various forms, capable of supporting humans in their daily lives. For some animal-loving humans, pets are now considered part of their owner's role in human activities and lifestyles. The increase in the number of pets has correlated with an increase in the elderly population. Pets are usually treated as if they were family members. The most common pets are dogs and cats. Every year, the pet care industry and businesses continue to grow, and the need for products with innovative technologies is critical to supporting seniors in caring for their pets.

2.2 IoT in Smart Pet Feeder

When the owner is not available, the automatic pet feeding system ensures that pets are fed on time, enabling the owner to focus on other responsibilities. The Automatic Pet Feeding System features a nice design and a nice model. The Arduino and IoT bring automation to the system. [3]

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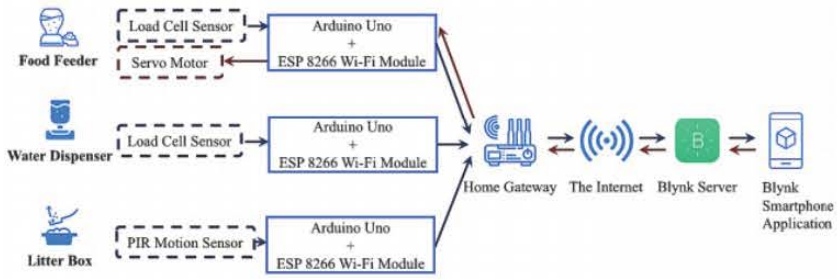
Aside from that, smart pet feeder customers may utilise an Android phone to send MQTT publish messages to a MQTT server via an APP. The microcomputer acts as an MQTT server, receiving MQTT messages delivered by mobile phones. The GPIO signals are then sent to the motor hardware by the microprocessor through its PINs.[4]

To allow all components to connect with the same project in Blynk, the authors used the feeder's authentication token, which is received when the Blynk project is formed. [5]



Source:[5]

Figure 2.1 Block diagram of pet care system

Smart pet feeder is mostly produced a basic function same as the product that we can find in the market. The designed with the weight sensor and timer can measured the amount of the food and check the time interval and it can act on time basis with timer set. With the good design, it can be done by using user smart phones. User can receive the status of smart pet feeder through the specific smart phone applications. Many result shown that smart pet feeder can be design by IoT. [6]

Furthermore, with the advent of Internet of Things (IoT) technology, there has been a substantial shift in people's lives, and we have entered an era in which a greater range of items, rather than simply computers or mobile phones, are linked. The IoT has enabled us to perceive and manage the physical world by making items smarter and linking them via an intelligent network, hence "connecting the disconnected." [5]

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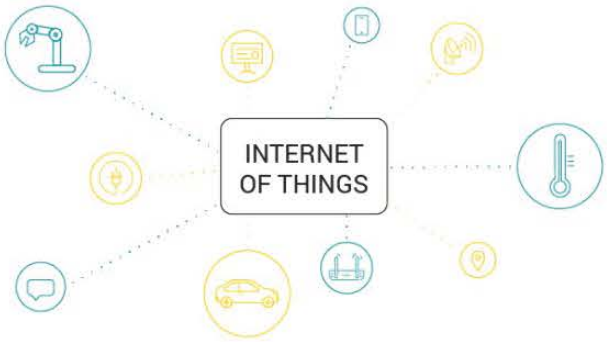
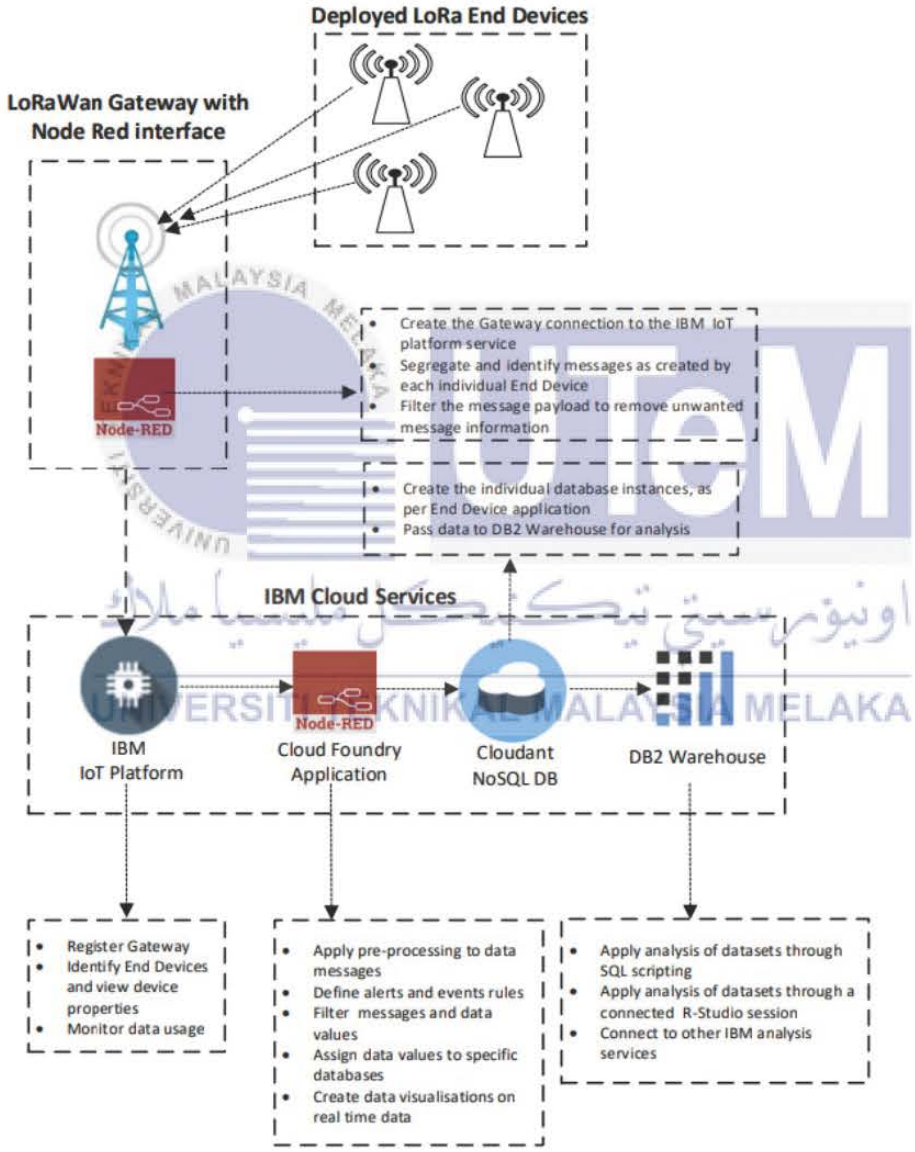


Figure 2.2 Internet of things technology

2.3 Important of using IoT

IoT has a significant impact on the lives of millions of people around the world. It is used in a variety of societal contexts to reduce human interaction and directions and provide highest automation.Other than that,with the help of vibration-based condition monitoring, IoT enabled industrial condition monitoring solutions for Industry 4.0 can be quantified.Over time, LoRaWan has primarily been used to focus on its operation and performance as an LPWAN technology, with fewer specific application deployments. [7]



Source:[7]

Figure 2.3 IoT System: Design architecture and methodology

The fundamental core of the IoT area is connected to intelligent objects, and their behaviour is dependent on an interoperable modelling system. Furthermore, the IoT communication protocol provides a lightweight way to deal with intelligent devices. Furthermore, there are two types of nodes in the IoT: active and passive. A passive node is a backup node that will take over immediately if the active node fails. [8]

Table 2. 1 The similarities and differences between IoT, Internet and WSN

Characteristic	IoT	WSN	Internet
Communication Protocol	Lightweight	Lightweight	TCP/IP
Scale of Area	Cover wide area	Cover wide area	Cover local area
Type of Nodes	Active and Passive	Active	Active
Identifying Object	Must	Disable	Enable

(Source: [8])

Due to the general industrial IoT, the integration of IoT cross-industry will develop in the future, and IoT implementation will become widespread in human lives. [9]

Hence, the use of IoT is appropriate in the design of this project. This project aims to create a system that allows owners to monitor their pets automatically at any time and from any distance without having to physically inspect the pet food on site, as well as a detection system that will notify the user via an installed application when it is time for the pet to eat.

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2.4 Solar as power supply

Solar energy is the most important and renewable source of energy known to humans. As a solution, solar trackers are being added to improve the efficiency of solar energy systems at the expense of system complexity and cost. When solar cells are at the proper angle with the sun, which means solar radiation falls vertically on the solar cell, they produce greater energy and efficiency. A sun tracking system is used to do this.[10]

Besides that, when the sun's rays strike a solar photovoltaic module (SPV) at a right angle, it collects the most solar radiation. This can be accomplished using either a continuous tracking system or module mounts with an optimal tilt angle. However, for ideal tilts, a small deviation (75°) is permissible. The best orientation for a solar energy system is determined by the site's latitude, date, and time of year. [11]