Faculty of Electrical and Electronic Engineering Technology

AUTOMATIC PET FOOD FEEDER USING IOT CONTROLLED STEPPER MOTOR

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APPROVAL

I approve that this Bachelor Degree Project 2 (PSM2) report entitled "**AUTOMATIC PET FOOD FEEDER USING IOT CONTROLLED STEPPER MOTOR**

" is sufficient for submission.

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Date : 11 JANUARY 2022

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ABSTRACT

Electric engines are now widely used in a variety of disciplines of design and in all parts of our daily lives. Distinct types of electric engines are designed to satisfy specific needs. The size of the stepper engine control using the Arduino processor through the Internet is now being introduced. The main goal of this study is to plan and control the stepper engine from a far using an Android smart phone application designed for the Internet of Things (IoT), which can regulate the stepper engine's advancement size from a far. The suggested IoT-based stepper engine control is approved through continuous execution on the Ardunio board, and the internet page is maintained with the help of online content management. "Android," the world's most well-known versatile stage, is a tool for creating applications that look great and take advantage of hardware capabilities. The advantage of Android is that it is an open-source operating system that is used in a portable application that is a sophisticated mobile phone that can be used as a remote control. For the Internet of Things, remote systems are widely used as a systems administration technology (IOT). They can be used to exchange control instructions and information between machines, despite the fact that they were originally designed for speech communication systems. A lot of people like having all of their gadgets and devices work together so that they can be more convenient, comfortable, and energy efficient. This project is all about making the experience even more personalised for the user by using automation of electronics and IoT. This study came up with a way to feed your pet that is divided into two main parts: measurements and control. The system controls how the stepper motor moves and how much food is in the tank.. We were able to create a versatile remote stepper thanks to a combination of proprietary software and unique equipment.

ABSTRAK

Enjin elektrik kini banyak digunakan dalam pelbagai disiplin reka bentuk dan di semua bahagian kehidupan seharian kita. Jenis enjin elektrik yang berbeza dirancang untuk memenuhi keperluan tertentu. Ukuran kawalan mesin stepper menggunakan pemproses Arduino melalui Internet kini diperkenalkan. Matlamat utama kajian ini adalah untuk merancang dan mengendalikan mesin stepper dari jauh menggunakan aplikasi telefon pintar Android yang direka untuk Internet of Things (IoT), yang dapat mengatur ukuran kemajuan mesin stepper dari jauh. Kawalan mesin stepper berasaskan IoT yang disarankan diluluskan melalui pelaksanaan berterusan di papan Ardunio, dan halaman internet dikekalkan dengan bantuan pengurusan kandungan dalam talian. "Android," tahap serba boleh yang paling terkenal di dunia, adalah alat untuk membuat aplikasi yang kelihatan hebat dan memanfaatkan kemampuan perkakasan. Kelebihan Android adalah bahawa ia adalah sistem operasi sumber terbuka yang digunakan dalam aplikasi mudah alih yang merupakan telefon bimbit canggih yang dapat digunakan sebagai alat kawalan jauh. Untuk Internet of Things, sistem jarak jauh digunakan secara meluas sebagai teknologi pentadbiran sistem (IOT). Mereka dapat digunakan untuk menukar petunjuk dan maklumat kawalan antara mesin, walaupun pada hakikatnya alat ini dirancang untuk sistem komunikasi pertuturan. Ramai orang suka mempunyai semua alat dan peranti mereka berfungsi bersama supaya mereka boleh menjadi lebih mudah, selesa dan menjimatkan tenaga. Projek ini adalah tentang menjadikan pengalaman lebih diperibadikan untuk pengguna dengan menggunakan automasi elektronik dan IoT. Kajian ini menghasilkan cara untuk memberi makan haiwan kesayangan anda yang dibahagikan kepada dua bahagian utama: pengukuran dan kawalan. Sistem ini mengawal cara motor stepper bergerak dan jumlah makanan di dalam tangki.. Kami dapat membuat stepper jarak jauh serbaguna berkat gabungan perisian proprietari dan peralatan unik.

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CHAPTER 1

INTRODUCTION

1.1 Background

Smartphone is widely used among the society going through their daily life today. One of the recently popular application is The Internet of Things (IoT). The Internet of Things (IoT) is a new technology and commonly used these days where it has a self-configurable and adaptive system such as Thermostats, cars, lights, refrigerators, and more appliances can all be connected to the IoT. It is consist of network sensors including intelligent objects whose purpose to interconnect with many devices. All IoT applications, whether industrial, household, or others are controlled and monitored by a set of parameters that the user or "other" implements and executes. As a result, their implementation and execution varies depending on the set of parameters used for the execution that the user specifies or desires. One of the most essential things in this ecosystem is the Arduino board, which allows us to connect and control a variety of devices like as sensors, LEDs, step motors, servos, and mobile phones. Android Application to control a Stepper Motor "knob" according to user button slider input. All objects are in the same network for simplicity.

Stepper motors are a type of direct current motor that operate in distinct steps. They have a number of coils that are grouped into "phases." The motor will rotate one step at a time by activating each phase in order. Due to the fact that stepper motors have fewer mechanical components, they are affordable and durable. They are brushless, easy to position, and are frequently employed in automation systems, despite their tiny size and low power consumption in comparison to other types of motors. Stepper motor is widely used in the

industry today. We can see the implementation of stepper motor through computer controlled system. Stepper motor also used in tape drives, floppy disc drives, printers and electrical watch. It also has wide application in textile industries and integrated circuit fabrication.

This research will discuss the development of stepper motor using mobile application IoT which can be used to facilitate the industry. Wireless technology will be applied to control the stepper motor as a synchronous or asynchronous application.

Automated pet feeders is a choice for pet owners who don't want to feed their pets the old-fashioned way. The product makes it easier for pet owners to set the time and amount of food they feed their pets, which makes sure they get the right amount of food each day. People who have pets can use an automated feeder like this one so that they can teach their pets about how to eat and when to eat. People who use pet feeders don't have to think about how to feed their pets, and their pets will get their food. A survey by the Association for Pet Obesity Prevention found that 56% and 61% of dogs and 60% and 60% of cats are overweight, respectively. The pet owners were too busy with their jobs and didn't have time to take their pets for a walk. This caused their pets to become overweight. People who don't have a lot of time to exercise their pets also worry about forgetting to feed them, so they will put a lot of pet food in the bowl. This makes their pet eat too much. To solve the problem of pets being overweight and starving, a design for an automated pet feeder was made. This makes it easier for pet owners to feed their pets. It has been broken down into two types of motion, linear motion and rotational to linear motion.

1.2 Problem Statement

People now treat their pets as if they were part of the family. This is why, to keep your pet healthy, you need to think about and pay attention to a healthy diet. It will depend on the size of the pet how much and what kind of food it needs. People who own pets are often too

busy to take care of them, which causes their pets to be overweight. To make things even worse, pets can't get food on their own. They have to rely on the pet owner for that. It is because of I proposed an Automatic Pet Feeder using IOT Stepper Motor Controller and used to solve the problems of feeding a pet at the right time and with the right amount of food. When away, owner need to put a lot of food in pet tray because there is no one going to feed their pet.

1.3 Project Objective

The main objective of this research is to develop automatic pet feeder using IOT stepper motor controller. IoT will improve the stepper motor controller to make it more convenient to operate. Following methods is performed appropriately with investigate target that have been found such as:

a) To develope a stepper motor controller via smartphone.

b) To increase the efficiency to operate.

c) To create an automatic pet feeder that can control the amount of food and to give notification when the food in the tank exceding the low level that is already set.

1.4 Scope of Project

The scopes and limits to this research are:

a) IoT development of stepper motor controller.

b) Control the movement, speed and angle of the stepper motor quickly.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Based on the previous work and literature study related to a project, this chapter will give an overview. In this project, the focus was on develop a stepper motor controller using application of IoT.

2.2 Internet Of Things (IoT)

We are now in the age of smart technology, often known as "ubiquitous computing" or "web 0.3." The Internet of Things (IoT) has risen to prominence as a more promising place for expressing this type of innovative technology. Cloud computing is not the first technology in this industry, but it has been used to describe the ubiquitous computing environment. In the seventh in the series of ITU Internet Reports originally it was launched in 1997 under the title “Challenges to the Network”, and it was first coined by Kevin Ashton in the RFID journal 1999, In 2005 this name was changed to “Internet of things“.

The IoT environment contains a large number of different objects/things that can be classified into two categories:

1. Things with rechargeable batteries:

   The majority of them are mobiles (e.g., laptops, tablets, and cell phones).

2. Things without rechargeable batteries:

   These things are static from a mobility standpoint.

In general, the Internet of Things (IoT) involves three basic demands: The first is a shared understanding of its users' situations and applications. Second, software architecture and pervasive communication networks to cover and analyze contextual data and lastly IoT analytics tools aimed at autonomous and intelligent behaviour. (H. et al., 2015)

2.3 Characteristic of IoT.

Information technology has the potential to be a global platform for the future, providing upgraded services by integrating physical and virtual things and growing technologies based on links to additional and current data (Handigolkar et al., 2016)The Internet of Things (IoT) could be a complicated system with a few functionalities. IoT can make it easier for people to go about their regular lives. Many tasks can now be completed automatically with the help of IoT. There are a few characteristics that may be used to explain how IoT may assist individuals in their daily life. The characteristics of certain Internet of Things are as follows:

2.3.1 Intelligence

For the IoT, there are software and hardware algorithms, as well as helpful (particular) mathematical algorithms for intelligent behavior. IoT intelligence is concerned only with device interaction, whereas normal input techniques and graphical user interfaces lead to interaction between the user and the device. (Handigolkar et al., 2016)

2.3.2 Connectivity

IoT is enabled by networks that connect common objects. Because contact with basic things contributes to the IoT network's collective intelligence, these objects must be connected.

With that connectivity, the Internet of Items can provide new markets and goods through the networking of intelligent things and applications ((Handigolkar et al., 2016)

2.3.3 Sensing

It is possible to argue that IoT cannot function without sensors. Sensors in the Internet of Things detect or measure changes in the environment in order to offer information about their state or even interact with it. Sensing technologies enable the development of capacity that represents true awareness of the world and its inhabitants. Sensitive information is just one small contribution that the present world can offer to our complicated globe (Handigolkar et al., 2016)

2.3.4 Heterogeneity / Diversity

One of the fundamental characteristics of the Internet of Things is its heterogeneity. IoT devices use a variety of hardware and network platforms to communicate with other devices and services through the internet. The Internet of Things (IoT) should allow heterogeneous networks to interact directly. ((Handigolkar et al., 2016)

2.3.5 IOT Architecture

IoT architecture is made up of several layers of technologies that support IoT. Its purpose is to show how different technologies interact with one another as well as to communicate the scalability, modularity, and configuration of IoT deployments in various scenarios.

A. Smart device / Sensor layer.

There are smart devices that have sensors built in on the bottom layer, like phones and tablets. They connect the physical and digital worlds, which allows for the collection and processing of real-time data. This is why sensors are important. Sensors come in a wide range of shapes and sizes, and they can be used for many different things. Some of the things the sensors can look at are temperature and air quality; speed; humidity; pressure; flow; movement; electricity; and a lot more. Some of them may also have some memory, which lets them record a certain number of measurements in a certain way. When a sensor picks up on a physical attribute, it turns it into a signal that an instrument can understand. Environmental sensors, body sensors, home appliance sensors, and vehicle telematics sensors, for example, are all broken down into groups based on their specific use.

All but a few of the sensors need to be connected to the sensor gateways. LANs and PANs can be in the form of Ethernet or Wi-Fi, or they can be smaller networks like ZigBee, Bluetooth, or UWB (UWB). When sensors are connected with wide area network technologies like GSM, GPRS, and LTE, they can be connected to backend servers and applications that don't need to be connected with sensors. Wireless sensor networks: Sensors that connect with low-power and low-data-rate connections are called that (WSNs). There are more and more people using WSNs because they can handle more sensor nodes while still having enough battery life and covering a bigger area (Patel & Keyur, 2016)

B. Gateways and Networks

There will be a lot of data coming from these small sensors, so they will need a reliable and high-speed wired or wireless network infrastructure to move it. M2M networks and their applications have been able to use current networks, which usually use a lot of different types of protocols. It takes a lot of different networks with different technologies and access protocols to support a wide range of IOT services and apps, like high-speed transactional

services, apps that know where you are at all times and so on. It doesn't matter if they're private or public, public or hybrid. They're built to meet communication needs like latency or bandwidth.(Patel & Keyur, 2016)

C. Management Service Layer

Through analytics, security controls, process modeling, and device management, the management service enables the processing of data.

The business and process rule engines are one of the most significant components of the management service layer. IoT connects and interacts with objects and systems to provide information in the form of events or contextual data such as product temperature, current position, and traffic statistics. Some of these events necessitate filtering or routing to post-processing systems, such as the collecting of periodic sensory data, while others necessitate urgent responses, such as responding to medical emergencies. To enable a more responsive IOT system, rule engines facilitate the formulation of decision logics and activate interactive and automated operations. Various analytics tools are used in the field of analytics to extract important information from huge amounts of raw data and analyze it at a much faster rate. Large amounts of data can be cached in random access memory (RAM) rather than stored on actual drives using analytics like in-memory analytics. In-memory analytics speeds up decision-making by reducing data query time. Streaming analytics is a type of analytics in which data analysis, referred to as data-in-motion, must be done in real time so that choices can be taken in a matter of seconds(Patel & Keyur, 2016).

2.4 Stepper Motor.

DC motors that move in discrete increments are known as stepper motors. They have a number of coils that are grouped into "phases." The motor will rotate one step at a time by activating each phase in order (Earl, 2020).

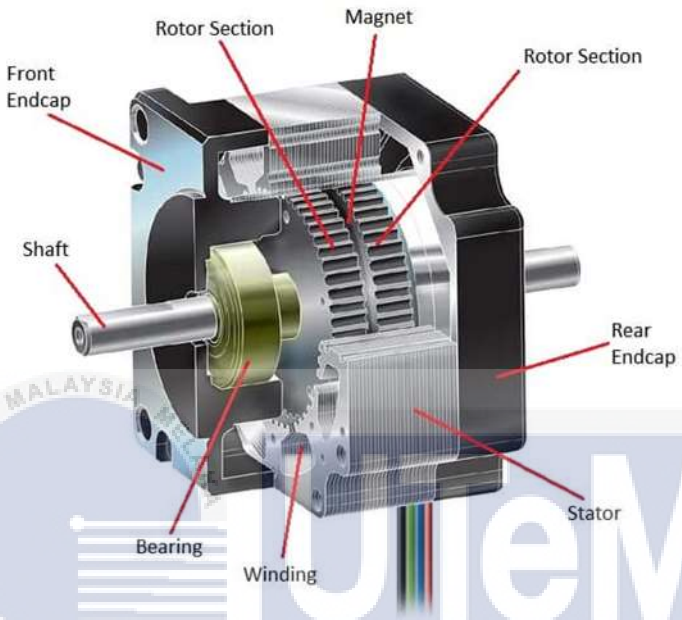

Figure 2.1: Stepper Motor Diagram

You can achieve very precise positioning and/or speed control with computer controlled stepping. As a result, stepper motors are the preferred motor for a wide range of precision motion control applications. Stepper motors come in a wide range of sizes, configurations, and electrical properties. This tutorial will explain how to choose the appropriate motor for the job. (Earl, 2020)

2.4.1 The advantages of Stepper Motor.

Stepper motor have an advantages that will help industry in certain situation. Some of the advantages are:

I. Positioning - Steppers excel in applications requiring precise positioning, such as 3D printers, CNC, camera platforms, and X, Y plotters, because they

move in precise repeatable steps. Stepper motors are also used in some disk drives to position the read/write head.

II. Speed Control - For process automation and robotics, precise increments of movement allow for excellent control of rotational speed.

III. Low Speed Torque - At low speeds, normal DC motors have very little torque. Stepper motors have the highest torque at low speeds, making them ideal for applications requiring low speed and high precision.

(Earl, 2020)

2.4.2 Type of Stepper

There are many different types of steppers, some of which necessitate highly specialized drivers. We'll concentrate on stepper motors that can be driven with readily available drivers for our purposes. (Earl, 2020)

The following figures show the type of Stepper:

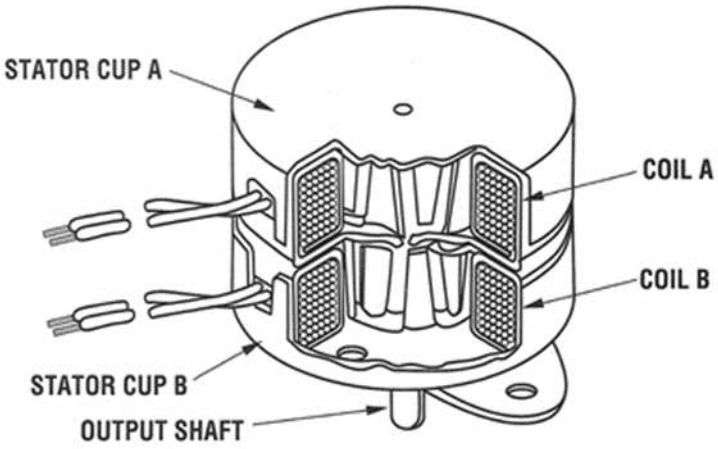

Figure 2.2: Hybrid or permanent magnet steppers

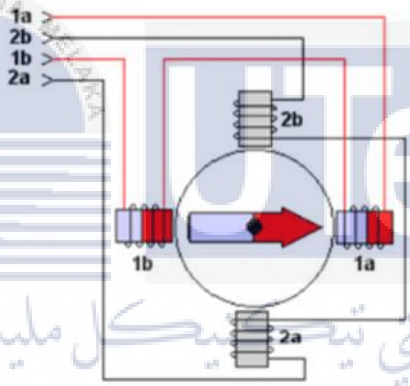

Figure 2.3: 2-phase bipolar

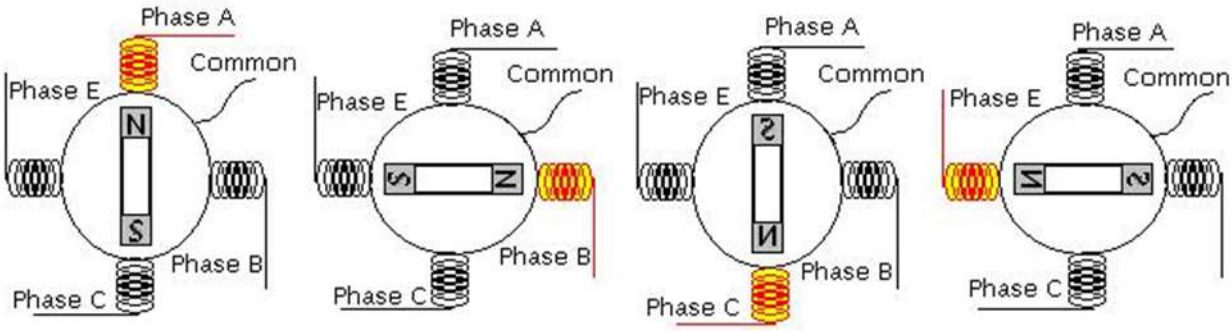

Figure 2.4: 4-phase unipolar.

Unipolar	Bipolar
Always energize the phases in the same way	Use H-bridge circuitry to actually reverse the current flow through the phases
The "common" lead, will always be negative. The other lead will always be positive	By energizing the phases with alternating the polarity, all the coils can be put to work turning the motor.
4 phase unipolar motor has 4	Two phase bipolar motor has 2 groups of coils

Table 2.1: The difference between Unipolar and Bipolar motor

(Earl, 2020)

2.4.3 Stepper Driver

It's a little more difficult to drive a stepper motor than it is to drive a regular brushed DC motor. To make a stepper motor turn, a stepper controller must energize the phases in a timely sequence. There is 4 type of driver that can be use:

A. Simple Unipolar Driver

With just a few transistors, the most basic sort of driver can be constructed. To energize the phases and step the motor, these are simply turned on and off in order. Unipolar drivers are simple to construct, but they only function with unipolar motors. The Arduino website has a great instruction on how to make one. (Earl, 2020).

B. Simple Dual H-Bridge Driver

To drive a bipolar motor, two full H-bridges are required to reverse the current to the phases. H-bridges are difficult to construct from the ground up. However, there are numerous H-bridge chips available to make the task easier. One of the most popular and cost-effective chips is the L293D. Most first-generation motor shields, notably the wildly popular V1 Adafruit Motor Shield, have them at their core.(Earl, 2020)

C. Adafruit Motor Shield V2

The Adafruit Motor Shield V2 is a significant improvement over the original L293D controllers. Two TB6612 MOSFET drivers are used in the V2 shield. The TB6612 has double the current capacity and substantially smaller voltage dips than the L293D, allowing you to operate your steppers more efficiently. Each shield can drive up to two stepper motors thanks to its two driver chips and four complete H-bridges. A special PWM driver chip with an I2C interface connects the driver chips. This frees up a number of GPIO pins for various purposes, and it also allows the shield to be stacked. With just two IO pins, you can control 64 motors by stacking up to 32 of them. (Earl, 2020)

2.5 Proposed System

The stepper engine cannot be directly controlled from the controller. As a result, it is commanded via stepper engine driver circuits. Currently, the L298N stepper engine driver circuits are in use. The power supply unit fuels the controller, stepper engine driver, and Wi-Fi module. The clever mobile phone is connected to the internet via WI-FI, as the android application is accessed via the android operating system. The site page depicts the stepper