SMART IRRIGATION SYSTEM BASED ON INTERNET OF THINGS WITH VOICE COMMAND

by

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TABLE OF CONTENTS

LIST OF TABLES

PAGE

LIST OF FIGURES

LIST OF ABBREVIATIONS

RPi	Raspberry Pi
IoT	Internet of Things
Node MCU	ESP 8266 Wi-Fi module
SoC	System on a Chip
OOP	Object-Oriented Programming

SISTEM PENGAIRAN PINTAR BERDASARKAN INTERNET OF THINGS DENGAN ARAHAN SUARA

ABSTRAK

Sistem pengairan pintar adalah lebih inovatif, mesra pengguna, menjimatkan masa dan lebih cekap daripada sistem sedia ada. Sistem pengairan pintar adalah penting untuk hortikultur untuk mendapatkan pulangan yang tinggi di kawasan sederhana kering dan total kering yang memerlukan sistem kawalan air untuk pelbagai jenis tanaman. Pengairan tumbuh-tumbuhan adalah satu aktiviti yang mengambil masa dan memerlukan banyak sumber manusia, juga menggunakan air secara berlebihan. Menurut isu sistem pengairan yang sedia ada, system pengairan secara manual adalah satu kaedah yang digunakan untuk menyiram tumbuhan. Selain itu, masalah lain pula ialah masalah pengguna yang mempunyai kecacatan fizikal yang menghadapi masalah dalam mengendalikan sistem pengairan. Oleh itu, objektif kajian ini adalah: (i) untuk membangunkan sistem pengairan pintar dengan arahan suara yang bersepadu yang membantu petani menyiram ladang mereka serta dapat mengurangkan penggunaan air untuk pemuliharaan yang lebih baik; dan (ii) menyediakan sistem pengawasan yang membantu petani memantau tanaman. Untuk memenuhi objektif penyelidikan, skop penyelidikan memberi tumpuan kepada pembangunan sistem pengairan pintar yang berdasarkan Internet Perkara (IoT) untuk membantu petani dengan mudah memantau dan menguruskan aktiviti pertanian. Untuk memudahkan semua jenis pengguna, tanpa mengira pengguna yang normal fizikal atau pengguna yang mempunyai kekurangan fizikal, sistem pintar ini disepadukan dengan fungsi arahan suara. Oleh itu, untuk membangunkan sistem pintar ini berdasarkan teknologi IoT, raspberry pi, modul wifi, sensor kelembapan tanah (untuk mengukur tahap kelembapan tanah yang tepat, dan sensor bme280 (untuk mengukur suhu udara dan kelembapan udara) digunakan sebagai platform pembangunan. Selain itu, memandangkan sistem pintar ini disepadukan dengan arahan suara, modul pengecaman pertuturan digunakan. Semua modul ini telah berjaya diuji pada fungsi sistem pengairan pintar berdasarkan IoT dengan arahan suara. Berdasarkan keputusan ujian, ia menunjukkan bahawa fungsi sistem pengairan pintar dengan arahan suara adalah 100% tepat apabila petani berkesan dapat mengawal sistem pengairan pintar dengan arahan suara tanpa sebarang gangguan. Click here to enter text.

Smart Irrigation System Based On Internet of Things with Voice Command

ABSTRACT

The smart irrigation system is a more innovative, user-friendly, time-saving and more efficient than the existing system. The smart irrigation system is significant for horticulture to get high return in semiarid and bone-dry regions because the fields in requirements of the water system can contain various plants. The irrigation of plants is an activity that taking times and requires a lot of human resources, also consuming water excessively. According to the issue of the existing irrigation system, mass irrigation is one method used to water the plants. Besides, the other issue would be the difficulties of the user who has physical disabilities that having problems in handling the irrigation system. Thus, the objectives of this research are: (i) to develop a smart irrigation system with integrated voice command that assists the farmers in watering their plantations as well as that can reduce water usage for better preservation; and (ii) to prepare a monitoring system that helps the farmer to monitor the plant. To fulfil the objectives of the research, the research scope focuses on the development of a smart irrigation system that is based on the Internet of Things (IoT) as to assist the farmer easily monitoring and managing the plantation activities. To facilitate all types of users, no matter who has normal physical or user who has a physical impairment, this smart system is integrated with the functionality of voice command. Therefore, to develop this smart system that based on IoT technology, the raspberry pi, wifi module, soil moisture sensors (to measure the exact moisture level of soil, and BME280 sensor (to measure the temperature of air and the humidity of the air) are used as the development platform. Also, as this smart system is integrated with voice command, the speech recognition module is used. All of these modules have been successfully tested on the functionality of the smart irrigation system based on IoT with a voice command. Based on the testing results, it shows that the functionalities of the smart irrigation system with voice command is 100% accurate when the farmer can effectively control the smart irrigation system with a voice command without any disturbance.

CHAPTER 1 : INTRODUCTION

1.1 Background

Agriculture assumes an essential job in social and monetary exercises of nations, for example, destitution decrease. Innovative change has given another shape to farming over the most recent 100 years. Agriculture has been viewed as the sign of the primary phase of improvement of any nation. In like manner, as sustenance comprises such a high consumption by poor people it is likewise superb to envision that lower nourishment costs, would be neediness decreasing. The reception of current agro-innovation gives gigantic advantage to help national nourishment security, support income and outside trade profit, through fares and empower industrialization all around the globe and increment the quantity of ranchers. Taiwan is utilizing biotechnology to help their agribusiness economy. South Korea's agribusiness had various natural issues. South Korea has been an uneven country with only 22 % arable region and less precipitation than most other neighbouring rice-creating countries (Mastoi, et.al 2014). Malaysia has marvellous strengths in agriculture, large scale production of industrial crops like oil palm and rubber as well as selected crops, and livestock, but currently, Malaysia needs to advance in agro-tech like other countries, (Shashkov, et.al 2014) as farm technology develops, control of irrigation systems is becoming more sophisticated.

1.2 Problem Statement

Watering of plants is regularly a very time-consuming activity to be completed in a reasonable amount of time, it requires a high number of personal support

traditionally, and all the steps were performed by a human. Now, these days, some tires use innovation to reduce the number of specialists in the time required for watering plants. With such frameworks, censorship is constrained and many assets are still wasted. Water is one such asset that is used unnecessarily. The collective water system is one of the strategies used for watering plants.

Due to the calculation of the traditional water system is not considered water saving. Since water is legally submerged in the ground, plants suffer from serious concern from a variety of soil moisture, and thus the appearance of the plant decreases. The non-appearance of planned controlling of the structure results in the unsuitable water control structure (Tyagi, 2017). The true goal behind those constraints is the development of populace which is amplification at a quicker rate.

At present there is rising worldwide water emergency where overseeing shortage of water has turned into a genuine activity. This development can be found in nations which have deficiency of water assets and are monetarily poor (Dlodlo and Kalezhi, 2015) such as in South Africa and Zambia. So this is the serious problem in smart irrigation system, This method representations massive losses since the amount of water given is in excess of the plants' needs, country territories in South Africa and Zambia face various comparable issues in the spaces of farming, the travel industry, ecological administration, account, interchanges, foundation network, water assets the executives, sanitation, streets and transport, access to business sectors, wellbeing and training, which calls for comparable however locally important answers for be coordinated towards fathoming issues identified with these likenesses.

In addition to the problem that related to the irrigation system is there would be difficulties to the user who has physical disabilities that having problems on handling the irrigation system such who needs voice functionalities in handling the irrigation system. Thus, there is a need for a smart irrigation system that is integrated with a voice command to assist the user to handle the irrigation system.

The contemporary impression of water is that of a free, inexhaustible asset that can be utilized in plenitude. Be that as it may, this isn't reality, in Malaysia water utilization should be paid (Shiva, 2016). It is there sensible to expect that it will before long become an over the top expensive asset all over. Notwithstanding the abundance cost of water, work is ending up increasingly costly. Subsequently, if no exertion is put resources into enhancing these assets, there will be more cash associated with a similar procedure. Innovation is presumably an answer for diminish costs and anticipate loss of assets. Other than that, the homestead fields of ranchers are arranged miles from his home. Now and again they have to go to his field for a few times in multi day to begin and stop the water system water pumps, coming about a few outings per day to work the pumps.

1.3 Objectives

The main aim of this project is to reduce the consumption of water in agriculture field and to bring a system which is solely based on Internet of Things where all information is viewed and controlled in fingertips.

The following aspects have been count into consideration:

• Water consumption

• Minimal project cost

• Less labour

• Power consumption

Therefore, there are two (2) objectives has been set up:

1. To develop a smart irrigation system with integrated voice command that assists the farmers in watering their plantations as well as that can reduces water usage for better preservation.

2. To prepare a monitoring system that helps farmer to monitor the plant.

1.4 Project Scope

Due to time limitations, it has been decided to orient this project to accomplish two (2) goals. First, is to develop an irrigation system that reduces water usage. The system will use the dripping method instead of sprinkling method to irrigate water as dripping helps to reduce water more compared to sprinkling. Second is to develop an application system to assist farmers and gardeners monitor their land.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

There is no doubt that agriculture is at the forefront of the most important achievements of human progress on this earth, so most specialists were concerned about the construction of this social achievement and logical techniques and innovation is ideal with the current period to ensure the maximum degree of creation despite its best types since gardening is the backbone for the economy of many countries around the world and give an abnormal state of solace to cattle, one of the strategies used to achieve this goal is a programmed water system for its benefits (Vaishali, et.al 2017).

Here are two ways to accomplish this task:

First: is the method of time-based automatic irrigation where the irrigation system is operated at specific times and for a pre-determined period by the farmer

Second: Automatic irrigation based on environmental variables of pressure, temperature and humidity.

Water sparing is critical in the water system framework. Thus, it is evident that in the two cases water spares must be considered. So a sprinkler or dribble water system framework ought to be utilized, where customary water system strategies spend in any event 85% of clean water despite the earnest requirement for clean water in this age (Sahu, 2017). On the other hand, the principal strategy does not think about the factors of nature,

as it water system the plants inside the predetermined period regardless of whether the plants needn't bother with a water system, this prompts misuse of water notwithstanding negative consequences for plant development and quality. In the second case the water system procedure will be done just on minimal conditions, for example, low soil dampness level to a limited degree or high temperature over the required rate. Where ecological parameters, for example, soil dampness, temperature, moistness, pH, sunlight based radiation and so forth assumes a significant job in the generally speaking advancement of the plant.

Temperature affects many plant exercises, for example, fertilization, germination, and so on. It is noted that the rate of breathing increases at higher temperature leads to lower sugar in foods grown from the ground. At low temperatures, optical motion retracts. Humidity is responsible for the humidity calamity and temperature of the executives of the industrial facility. For a high wet condition, the fading will be less soaked and soaked in the leaf area. This results in an extension and a piece of growth in the permeability area of the sheet. Moisture is essential for seed germination and dietary supplementation by the plant. Excess water may interrupt soil-air trade, reducing the breadth and development of roots. The ideal dimension of moisture ensures the strong development of the root and in the overall progress of the plant.

2.2 Smart Irrigation

The smart water system is significant for horticulture to get high return in semiarid and bone-dry regions, on the grounds that the fields in requirements of the water system can contain various plants, for example, trees, grass, and vegetables, each field ought to be flooded in an alternate arrangement having diverse period and sum. Obviously, the individual who waters the field ought to be knowledgeable about water system techniques for the plants to have yielded from the plants. If there should be an occurrence of wrong water system techniques, the normal horticultural yield can't be most presumably taken. In this unique circumstance, it is obviously observed that an auto-water system framework is of much significance to take the most astounding yield (Tyagi, 2017). The old water system strategies are sprinklers and flood type framework. In these strategies, the utilization of water is in extensive sum. On account of inclines in the field substantial measure of water moves downwards. Consequently, the rest of the piece of the field remains unirrigated. There is a lot of water wasted in these ways (Featherston, 2015).

2.3 Voice Command

Voice Command is a gadget obliged by techniques for the human voice, by removing the need to use gets, dials, and switches, buyers can without a lot of stretch work machines with their hands full or while doing various endeavours. Few basic voice commands events can be found in home appliances with washing machines that enable customers to work on laundry controls via voice bearings and mobile phones through voice interactions. Voice module is the most basic bit of the system that urges the structure to be instinctive. It realizes Inter-Dynamic Voice Response System that empowers

constant correspondence. As shown by the customer course, a reasonable response which is a pre-recorded voice message is delivered and transmitted to the customer by methods for GSM organize (Baviskar and Dsouza, 2014).

2.4 System Design of Smart Irrigation with Voice Command

The entire automatic irrigation system can be divided into two modules: (i); Speech to text convertor based command control system, and (ii); Sensor Nodes based remote monitoring module.

Speech to text convertor based control: the first module which consists of a separate module for the speech to text conversion, cellular interface, a Bluetooth Serial Port Adaptor (SPA), the microcontroller and the motor control. There is also a RF trans-receiver for communication with the wireless sensor nodes.

Speech to text converter: The user needs to speak the command words through the microphone and the voice is sample processed to recognize the uttered word. The processes involved in speech to conversion.

The Hidden Markov Model (HMM) is utilized to perceive the words. A Vocabulary of ten words (digits 0-9) can be perceived through this module usage. So as to sift through the commotion for discourse.

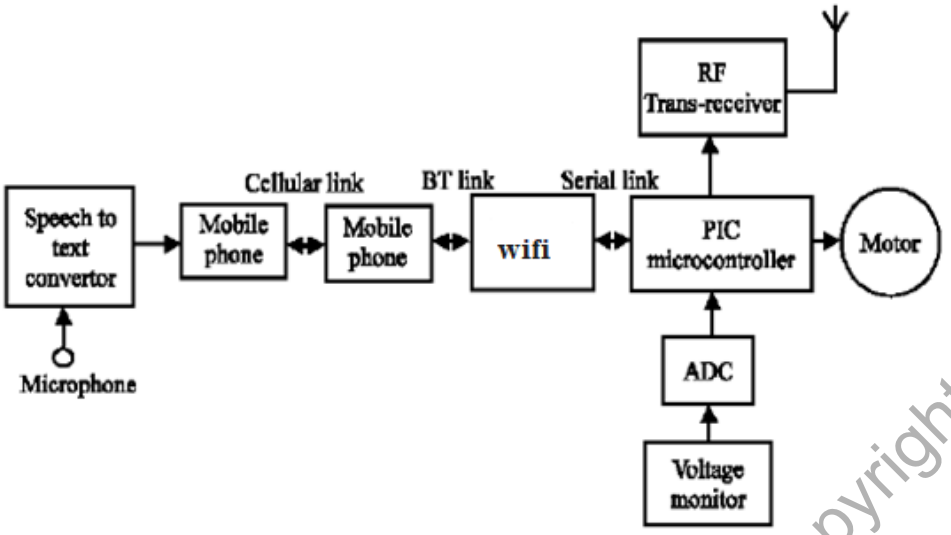

Figure 2.1 : System Discription Command Control System

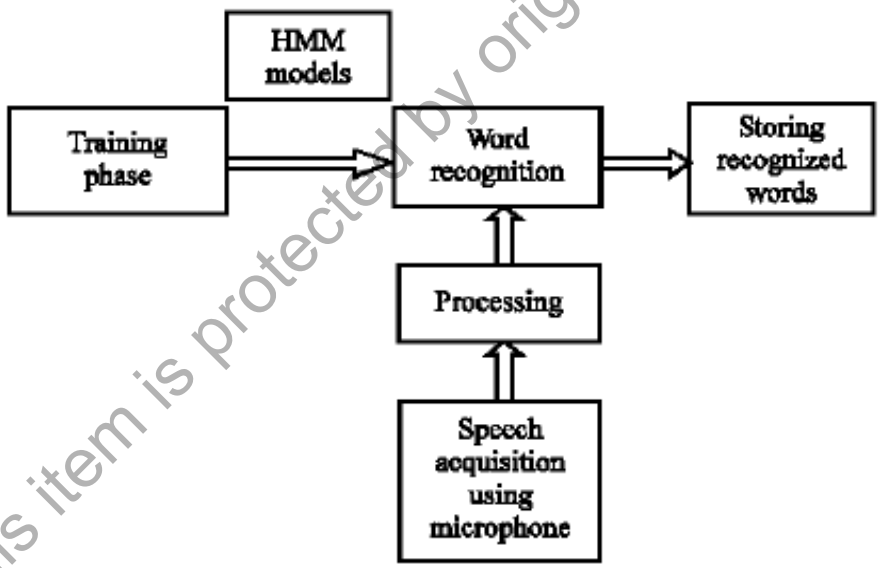

Figure2.2: Block Digram For Speech To Text Conveter

These commands are converted into texts using an additional module interfaced with the user's mobile phone. Thus the farmer need not type the message. He just needs to speak few commands to activate the system and monitor it. In addition, the wireless sensor network consisting of the temperature and humidity sensors gathers the field's information and sends it to the main controller for remote monitoring.

2.5 System on the chip (SoC)

A system on a chip (SoC) combines the required electronic circuits of various computer components onto a single, integrated chip (IC). SoC is a complete electronic substrate system that may contain analog, digital, mixed-signal or radio frequency functions. Its components usually include a graphical processing unit (GPU), a central processing unit (CPU) that may be multi-core, and system memory (RAM).

Because SOC includes both the hardware and software, it uses less power, has better performance, requires less space and is more reliable than multi-chip systems. Most system-on-chips today come inside mobile devices like smartphones and tablets.

2.5.1 Raspberry Pi (RPi)

Raspberry Pi is a credit card-sized computer that connects to a PC screen or TV, and utilization a standard console and mouse. It can do all that you would anticipate that a work station should do, from perusing the web and playing top-notch video, to making spreadsheets, word-preparing, structured and produced in the UK with the underlying goal of giving a shabby figuring gadget to instruction (Nazarko, 2013).

Figure 2.3: Raspberry Pi Model B + (Heikkia, 2015)

Operating utilized for Raspberry Pi is Raspbian as it is open source which any one can utilize, Raspbian is a Debian-based PC working framework for Raspberry Pi,it has 40 sticks in which 24 are GPIO pins these pins are utilized for universally useful, 8 ground pins, two of each 5V and 3V control pin. It has four USB-2 ports and Micro USB control source. It likewise comprises CSI camera port for associating the Raspberry Pi camera. It keeps running on 5V control supply (Namala, et.al 2017).

2.5.2 Hardware of Raspberry Pi (RPi)

The board has been managed by thinking of it as it is certainly not difficult to use. The Raspberry Pi board merges a processor and plans chip, a program memory (RAM) and different interfaces, and connectors for outer contraptions. Raspberry Pi works in like manner as a standard PC, referencing a console utilized for solicitation passage, a presentation unit, a power supply. RPi utilizes an SD Flash memory card commonly utilized in front line cameras, arranged in an equivalent as a hard drive utilized in PC. Raspberry Pi will stack the Operating System into RAM from this card additionally as a PC 'boots up' into Windows from its hard circle. Basic parts utilized in r raspberry pi gear are SD card having Linux Operating structure. USB, TV or screen having HDMI, DVI,

Composite or SCART input, power supply, video interface fit with the TV or screen utilized. Estimated parts are USB mouse, Internet connection, Model B: Wi-Fi USB connector, Internet alliance, Model B only: LAN interface, supported USB hub, status (Chaudhari, 2015).

The Raspberry Pi equipment has advanced through a few forms that highlight varieties in memory limit and fringe gadget support as shown in figure 2.4.

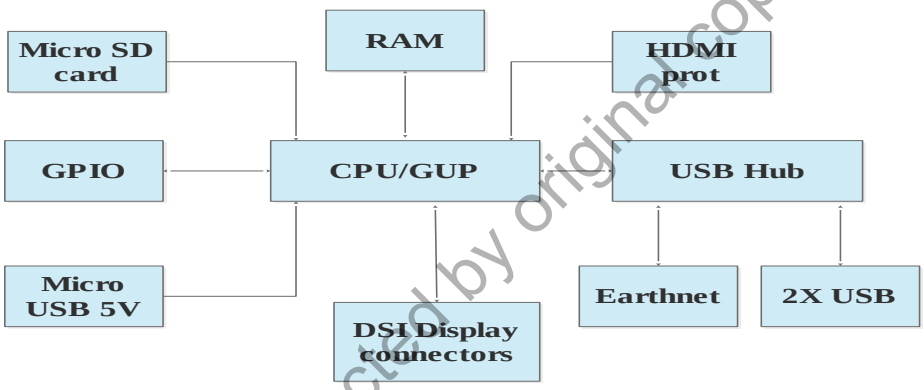

Figure 2.4: Hardware Component

2.5.3 Components on the Raspberry Pi Board

The core components of the Raspberry pi board are as follows:

1. **ARM CPU/GPU** Chip (SoC) that is comprised of an ARM focal handling unit (CPU) and a Video centre 4 designs preparing unit (GPU). The CPU handles every one of the calculations that make a PC work (taking information, doing figuring and delivering yield), and the GPU handles illustrations yield.