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IMPLEMENTATION OF GREENHOUSE SERVICE CONTROL PROTOCOL USING PYTHON ON RASPBERRY PI

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ABSTRACT

ICT technology is widely applied to various industries including agriculture. In the agricultural sector, most of the devices and greenhouses still use very old serial communication technologies. Nowadays, many ICT technologies such as ZigBee, Bluetooth and the Internet are spreading but still not interoperable. A set of standards is under development in Korea to ensure interoperability between different vendors. In particular, core interoperability can be provided by standardizing the LCP protocol independent of the underlying network infrastructure. In this paper, we designed service control protocol based on LCP protocol and implemented it using Python. We have deployed the implementation to Raspberry PI with actual physical devices.

Keywords—smart greenhouse, protocol, implementation, python

I. INTRODUCTION

ICT technology is applied to various industries beyond information and communication services, and agriculture is no exception. In the field of agriculture, communication technology is applied to facility automation and optimal growth environment control to acquire environmental information from sensors and control various actuators in the facility. Most of the devices use the Modbus protocol for the RS485 environment, which was created 30 years ago. Recently, ZigBee, Bluetooth, and IP based communication methods are gradually being applied. However, most vendors use their own protocols or arbitrary extensions to Modbus, it is difficult to seamlessly exchange or interwork with heterogeneous protocols that are tailored to each communication environment. To solve this problem, TTA, a Korean domestic SDO, has developed more than 20 related standards, and in 2018, TTA is developing a lightweight control protocol (LCP) that operates independently from the lower physical layer. We implemented a service control function (SCP) to control the smart greenhouse using the LCP protocol [1], and deployed it on Raspberry Pi. In addition, we developed a server to control sensor nodes through the web at remote sites. To increase the portability, we make the server as a docker container. This paper describes the experience of developing operation procedures of LCP-based service control protocol on Raspberry PI.

II. SMART GREENHOUSE CONTROL PROTOCOL

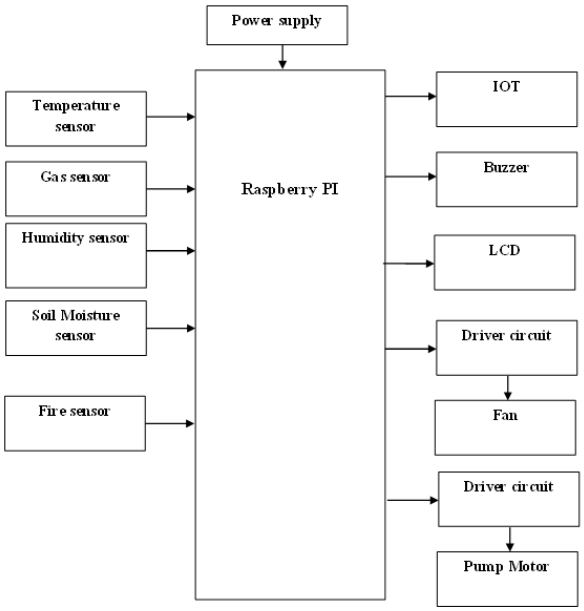
A node can attach various kinds of devices at the same time. It mainly provides communication function for control and has an adaptation layer suitable for physical communication environment.

1. POWER SUPPLY

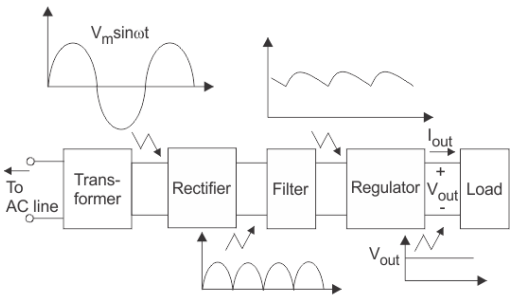
The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

Block diagram



A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.



Block Diagram of Power Supply

2. Raspberry Pi

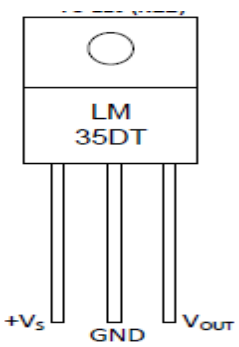
The Raspberry Pi is a series of credit card–sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools and developing countries. The original Raspberry Pi and Raspberry Pi 2 are manufactured in several board configurations through licensed manufacturing agreements with Newark element14 (Premier Farnell), RS Components and Egoman. The hardware is the same across all manufacturers

SPECIFICATIONS

	Model A	**Model B**	**Model B+**
Target price:	US$25	US$35	
SoC:	Broadcom BCM2835 (CPU, GPU, DSP, SDRAM, and single USB port)		
CPU:	700 MHz ARM1176JZF-S core (ARM11 family, ARMv6 instruction set)		
GPU:	Broadcom Video Core IV @ 250 MHz		
Memory (SDRAM):	256 MB (shared with GPU)	512 MB (shared with GPU) as of 15 October 2012	
USB 2.0 ports:	1 (direct from BCM2835 chip)	2 (via the on-board 3-port USB hub)	4 (via the on-board 5-port USB hub)
Video input:	15-pin MIPI camera interface (CSI) connector, used with the Raspberry Pi Camera Addon.		
Video outputs:	Composite RCA (PAL and NTSC) –in model B+ via 4-pole 3.5 mm jack, HDMI (rev 1.3 & 1.4), raw LCD Panels via DS		
Audio outputs:	3.5 mm jack, HDMI, and, as of revision 2 boards, I²S audio (also potentially for audio input)		
Onboard storage:	SD / MMC / SDIO card slot (3.3 V card power support only)		MicroSD
Onboard network:	None	10/100 Mbit/s Ethernet (8P8C) USB adapter on the third/fifth port of the USB hub	
Low-level peripherals:	8× GPIO, UART, I²C bus, SPI bus with two chip selects, I²S audio +3.3 V, +5 V, ground		17× GPIO
Power ratings:	300 mA (1.5 W)	700 mA (3.5 W)	600 mA (3.0 W)
Power source:	5 V via MicroUSB or GPIO header		
Size:	85.60 mm × 56 mm (3.370 in × 2.205 in) – not including protruding connectors		
Weight:	45 g (1.6 oz)		

3. Temperature sensor

Temperature is the most-measured process variable in industrial automation. Most commonly, a temperature sensor is used to convert temperature value to an electrical value. Temperature Sensors are the key to read temperatures correctly and to control temperature in industrials applications. A large distinction can be made between temperature sensor types. Sensors differ a lot in properties such as contact-way, temperature range, calibrating method and sensing element. The temperature sensors contain a sensing element enclosed in housings of plastic or metal. With the help of conditioning circuits, the sensor will reflect the change of environmental temperature.



Pin Definition

The definition of gray-scale sensor pin is

1. Signal Output
2. GND
3. Power

4. GAS SENSOR

A gas detector is a device which detects the presence of various gases within an area, usually as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down. A gas detector can also sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave the area. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors are very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.

5. HUMIDITY SENSOR

HR202 humidity Sensor resistance use the organic polymer materials, is a new type of humidity sensor, a sense of the wet range, long-term performance and stability, can be applied to warehousing, car, indoor air quality control, building automation, medical, industrial control systems and research fields a wide range of applications.

Technical parameters:

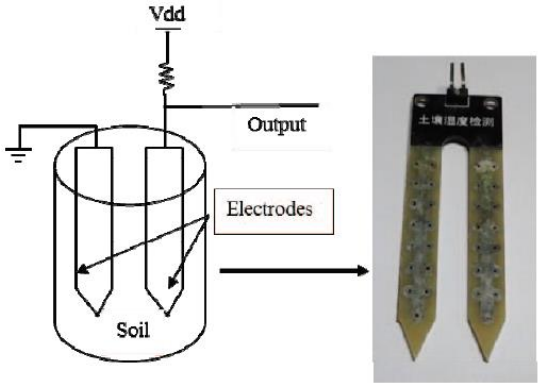
- Parameters: (at 1kHz) Unit: Ohm
- Operating range: 20 ... 95% RH 0 ... 60
- Supply voltage: 1.5V AC (Max sine wave)
- Frequency: 500Hz ... 2kHz
- Rated power: 0.2mW (Max sine wave)
- Central value: (at25 1kHz 1V AC 60% RH sine wave) 31.0kΩ
- Resistance range: (at25 1kHz 1V AC 60% RH sine wave) 19.8 ... 50.2kΩ
- Humidity detection accuracy : ± 5% RH

Application:

- Account for temperature and humidity display, temperature and humidity gift table, atmospheric environmental monitoring, industrial process control, agriculture, instrumentation and other applications

6. SOIL SENSOR

A SOIL type sensor is the easiest of soil moisture sensor but it is considered as being highly crude. It is suitable for an inaccurate measurement such as the soil being wet or not. The sensor uses the sol as the resistance medium and passes the current through the soil between the two electrodes. The resistance value represents the moisture content of the soil. By accumulating more water this makes the soil to have more conductivity; the moisture soil will be less than the dry soil. Fig shows a simple and very low-cost circuit of a resistor-based sensor



7. FIRE SENSOR

The Fire sensor, as the name suggests, is used as a simple and compact device for protection against fire. The module makes use of IR sensor and comparator to detect fire up to a range of 1-2 meters.
The device, weighing about 5 grams, can be easily mounted on the device body. It gives a high output on detecting fire. This output can then be used to take the requisite action. An on-board LED is also provided for visual indication.

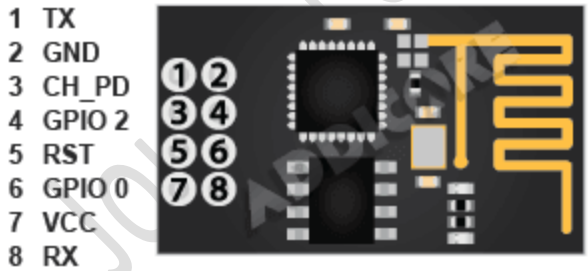
Feature

- Typical Maximum Range: 2 m.
- Indicator LED with 3 pin easy interface connector.
- Operating Voltage 5v

8. ESP8266 WIFI IOT MODULE

Specifications:

- 802.11 b/g/n
- Serial/UART baud rate: 115200 bps
- Integrated TCP/IP protocol stack
- Input power: 3.3V (see "Recommended Accessories" below for 3.3V power options)
- I/O voltage tolerance: 3.6V Max (see "Recommended Accessories" below for level converters to connect to higher voltage devices (i.e. Arduino))
- Regular operation current draw: ~70mA
- Peak operating current draw: ~300mA
- Power down leakage current: <10µA
- +19.5dBm output in 802.11b mode
- Flash Memory Size: 1MB (8Mbit)
- WiFi security modes: WPA, WPA2
- Module's dimensions: 24.75mm x 14.5mm (0.974" x 0.571")

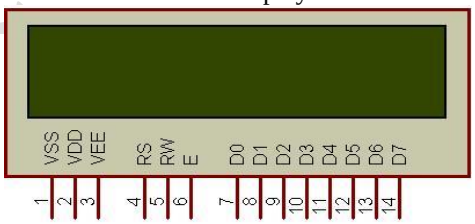


9. BUZZER

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, house hold appliances such as a microwave oven, or game shows.
It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

10. LIQUID CRYSTAL DISPLAY (LCD)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.
A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.
The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.



11. DRIVER CIRCUIT

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor.
In a single l293d chip there two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller.

There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

Pin Diagram

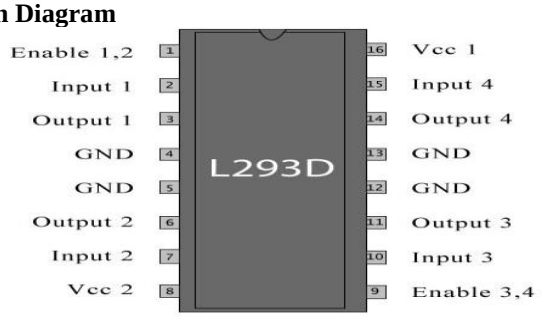


Fig showing pin diagram of L293D

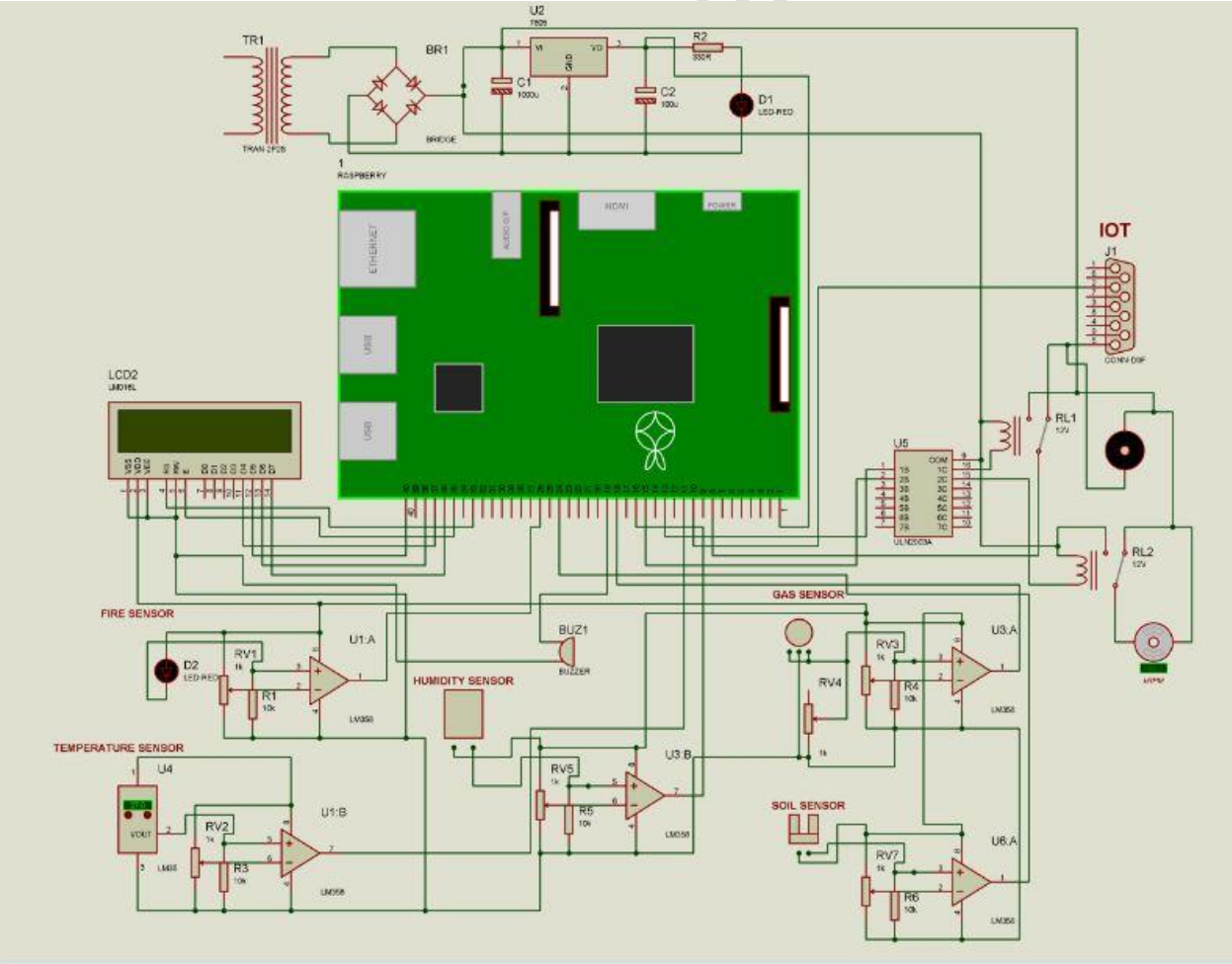
Specification:

- Max Flow Rate: 20L/H
- H-Max (Lift height): 1.6 feet
- Power: 6-18 Watt
- Voltage: 110 – 120/230 V @ 50 Hz
- Outlet: Fits 0.315" ID (inside diameter) tubing

12. Submersible Water Pump

This submersible pump is designed for reliability and ultra-quiet operation to provide years of service. The small profile size makes the pump easy to hide or disguise. Has adjustable flow and is easy to clean. This submersible water pump is great for aquarium, fountains, spout and hydroponic systems.

IMPLEMENTATION SCHEMATIC DIAGRAM



V. CONCLUSIONS

In this paper, we designed R.PI Based system, which is having an IOT protocol for controlling real service, using ESP8266 MODULE which can operate independently in lower physical layer among various methods for controlling Smart Greenhouse. In this process, the data related to the status information and control information necessary for controlling each service are defined and displayed in LCD. In addition, the designed protocol was implemented in python and installed in Raspberry PI to confirm the actual operation.

REFERENCES

[1] J.Y.Park et al, LCP for Managing Smart Greenhouse, ICTC2018

[2] CoAP, The Constrained Application Protocol (CoAP), IETF RFC7959

[3] W. Hyun et.al, Implementation of docker-based smart greenhouse data analysis platform, ICTC2018

[4] K. Shafiullah, K.P. Al-Saki, and A.A. Nabil, Wireless Sensor Networks - Current Status and Future Trends, CRC Press, 2012.

[5] F. Viani, F. Robol, A. Polo, P. Rocca, G. Oliveri, and A. Massa, "Wireless architectures for heterogeneous sensing in smart home applications: Concepts and real implementation," *Proc. IEEE*, vol. 101, no. 11, pp. 2381–2396, Nov. 2013.

[6] C. Gomez and J. Paredells, "Wireless home automation networks: A survey of architectures and technologies," *IEEE Communications Magazine*, vol. 48, no. 6, pp. 92-101, 2010.

[7] M. Alioto, Ed., *Enabling the Internet of Things—From Integrated Circuits to Integrated Systems*. New York: Springer-Verlag, 2017.

[8] M. Alioto and M. Shahghasemi, "The Internet of Things on Its Edge: Trends Toward Its Tipping Point," *IEEE Consumer Electronics Magazine*, vol. 7, no. 1, pp. 77-87, Jan. 2018.

[9] B. Martinez, M. Monton, I. Vilajosana, and J. Prades, "The Power of Models: Modeling Power Consumption for IoT Devices," *IEEE Sensors Journal*, vol. 15, no. 10, pp. 5777–5789, Oct. 2015.

[10] M. Magno, F. Ait Aoudia, M. Gautier, O. Berder, L. Benini, "WULoRa: An Energy Efficient IoT End-Node for Energy Harvesting and Heterogeneous Communication," in *Proc. of the Conference on Design, Automation and Test in Europe, DATE'17*, Lausanne, 2017, pp. 1528–1533.