IOT-PHASE 5

SMART WATER MANAGEMENT

Project Title: Smart Faucet System

An IOT based smart faucet in smart water management system consists of several hardware and software components that work together to collect the process data. The hardware components include sensors, micro-controllers and communication modules. The software components consists of Arduino IDE, a mobile application, and a web-based dashboard.

IOT MONITORING SYSTEM COMPONENTS:

The materials used to design an automatic water faucet that uses the HC-SR04 sensor are as follows:

1. The hardware used in this : a) Nodemcu Esp8266

b) HC-SR04 Sensors

c) Infrared Sensors

d) Relays 2 channels 5v

f) Water hose

g) Breadboards

h) Acrylic

i) Jumper Cable

j) Wifi /internet network

k) Smart phones

l) Water

m) Some Glue and insulation

n) Solder and Solder Tin

2. The software used in this : a) Arduino IDE

b) Blynk app

c) Raspberry pi

WORKING EXPLANATION:

Many activities related to water. In everyday life, the use of water is very important and necessary in various fields, such as households, industry and agriculture. One important aspect of water management is avoiding wastage. Many people often forget or accidentally leave the water tap open after use, which can result in significant water wastage. Along with the development of science and technology, it is now increasingly providing convenience in everyday life. Where all things that are widely applied to science and technology with machines or electronics, so that human work can be done easily. Internet of Things (IoT) is a concept whereby physical objects around us, such as electronic devices, vehicles, household appliances and many more, are connected to each other via the internet network. IoT enables these objects to collect and exchange data autonomously, as well as interact with other users or systems.

1.Tap water: The water faucet functions to control the amount of water that is released. Despite its small size, the presence of a water faucet is very important in everyday life. None other than everything related to water such as hoses and rooms bath will be easier to operate with tool. The design of a water faucet can also affect the beauty of a room or certain elements. Currently there are many selling water faucets in the market, both in terms of design and color.

2.Microcontroller: Microcontroller is a complete microprocessor system contained on a chip. Microcontrollers are different from multipurpose microprocessors used in a PC, because a microcontroller generally contains components that support a minimal microprocessor system, namely memory and Input-Output programming. Microcontrollers can be programmed to perform calculations, receive input and produce output. Microcontrollers are used in automatically controlled products and devices, such as machine control systems, remote controls, office machines, household appliances, heavy equipment, and toys.

3. NodeMCU ESP8266: NodeMCU is an Internet of Things (IoT) product development board based on ESP8266-12E Firmware. ESP8266 itself is a WiFi chip with a complete TCP/IP protocol stack. NodeMCU can be analogous to the ESP8266 arduino board. The ESP8266 program is a little difficult because it requires several wiring techniques and an additional USB to serial module to download the program. However, packaged the ESP8266 into a compact board with various features such as a microcontroller with access capability to Wifi as well as a USB to serial communication chip. So to program it, you only need a USB data cable extension exactly the one used for charging smart phones.

4. Arduino IDE : Arduino can be programmed with Arduino software. The Arduino IDE was developed from Processing software which was overhauled into an Arduino IDE specifically for programming with Arduino. Programs written using Arduino Software (IDE) are called sketches. Sketches are written in a text editor and saved in files with the extension IDE stands for Integrated Development Environment or in simple language is an integrated environment used for development. It is called an environment because it is through this software that Arduino is programmed as a built-in function with programming syntax. Arduino uses its own programming language, which is similar to C language. The Arduino programming language (sketch) has been changed to make it easier for beginners to program from the original language. Before being sold to the market, the Arduino microcontroller IC has been embedded into software called the bootloader , which acts as an intermediary between the Arduino compiler and the microcontroller.

5. Blynk App: The Blynk App is an application designed for the Internet of Things. This application is able to control hardware remotely. Blynk functions to create application projects using various variations of the widgets that have been provided. However, the limit for using widgets in one account is only 2000 energy. This energy can be added by buying it through the playstore.

6. HC-SR04 Ultrasonic Sensor: Ultrasonic sensor is a sensor that functions to convert physical quantities (sound) into electrical quantities and vice versa. The way this sensor works is based on the principle of the reflection of a sound wave so that it can be used to interpret the existence (distance) of an object with a certain frequency. Called an ultrasonic sensor because this sensor uses ultrasonic waves (ultrasound sound). Ultrasonic waves are sound waves that have a very high frequency of 20,000 Hz. Ultrasonic sound cannot be heard by the human ear. Ultrasound can be heard by dogs, cats, bats and dolphins. Ultrasonic sound can travel through solids, liquids and gases.

7. Definition of Water Pump: The pump is one of the fluid machines that are included in the working machine class. The function of the pump is to convert mechanical energy (work rotating the shaft) into fluid energy and pressure. A centrifugal pump basically consists of one or more impellers equipped with blades, which are mounted on a rotating shaft and enclosed by a casing. The fluid enters the impeller axially near the shaft and has potential energy, which is imparted to it by the blades. As the fluid leaves the impeller at a relatively high velocity, it is collected in a 'volute' or a series of diffusers which transform kinetic energy into pressure. This is of course followed by a reduction in speed. Once the conversion is complete, the fluid is then removed from the machine. Same for pumps with the exception that the volume of gases is reduced as they pass through the blower, while the volume of fluid is practically constant as it passes through the pump. Centrifugal pumps are essentially high-speed machines (compared to reciprocating, rotary, or displacement types.

8.Sensor: Sensors are transducers that function to process variations of motion, heat, light or light, magnetic and chemical into voltages and electric currents. The sensor itself is an important component in the equipment section, the sensor also functions as a tool to detect and also to determine the magnitude.

9. Infrared Sensors: The infrared sensor circuit uses photo transistors and infrared LEDs. The photo transistor will activate when exposed to light from the infrared LED. The distance between the obstacle or object is far away, which affects the intensity of light received by the phototransistor. The light emitted by the infrared LED will be read by the photodiode if there is an object in front of it.

PYTHON SCRIPT

Hardware Setup:

i)Raspberry Pi connected to the internet.

ii)A solenoid valve connected to a water supply.

iii)A relay module to control the solenoid valve.

iv)MQTT broker set up and running**.**

Python Code:

```
import RPi.GPIO as GPIO

import paho.mqtt.client as mqtt

import time

# Define GPIO pins

RELAY_PIN = 17

# MQTT Settings

MQTT_BROKER_HOST = "your_mqtt_broker_host"

MQTT_BROKER_PORT = 1883

MQTT_TOPIC = "smart_faucet/control"

# Initialize GPIO

GPIO.setmode(GPIO.BCM)

GPIO.setup(RELAY_PIN, GPIO.OUT)
```

```
# Callback when the client is connected to the broker
def on_connect(client, userdata, flags, rc):
 print("Connected to MQTT Broker with result code " + str(rc))
 client.subscribe(MQTT_TOPIC)
# Callback when a message is received from the broker
def on_message(client, userdata, msg):
 message = msg.payload.decode()
 print("Received message: " + message)
 if message == "on":
 GPIO.output(RELAY_PIN, GPIO.HIGH)
 print("Faucet turned on")
 elif message == "off":
 GPIO.output(RELAY_PIN, GPIO.LOW)
 print("Faucet turned off")
# Create an MQTT client
client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message
# Connect to the MQTT broker
client.connect(MQTT_BROKER_HOST, MQTT_BROKER_PORT, 60)
# Start the MQTT loop
client.loop_start()
try:
 while True:
 time.sleep(1)
except KeyboardInterrupt:
```

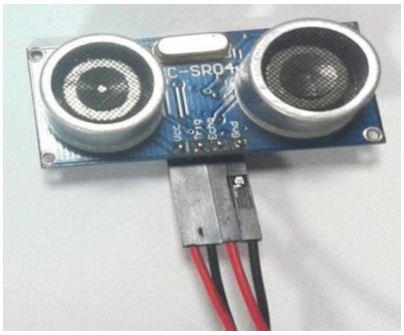
```
print("Exiting...")

GPIO.cleanup()
```

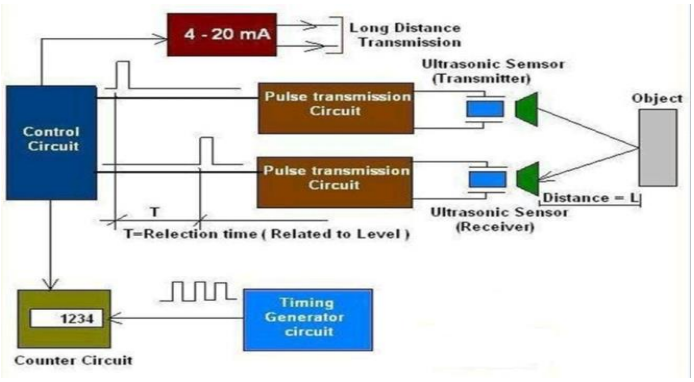
MAJOR COMPONENT'S PICTURE USED IN THESE PROJECT:

1. RASPBERRY-PI:

2. ULTRA SONIC SENSOR:



ULTRA SONIC TRANSMITTER-FUNCTIONAL BLOCK DIAGRAM



3.RELAY:

Features of 5-Pin 5V Relay:

Trigger Voltage (Voltage across coil) : 5V DC

Trigger Current (Nominal current) : 70mA

Maximum AC load current: 10A @ 250/125V AC

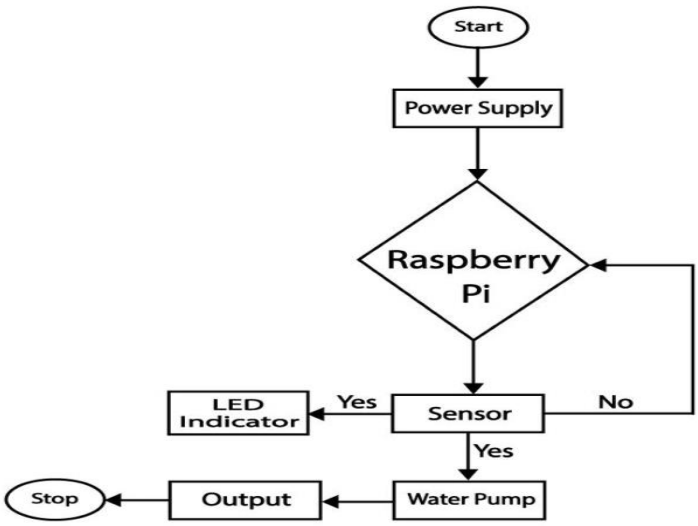
Maximum DC load current: 10A @ 30/28V DC

Compact 5-pin configuration with plastic moulding

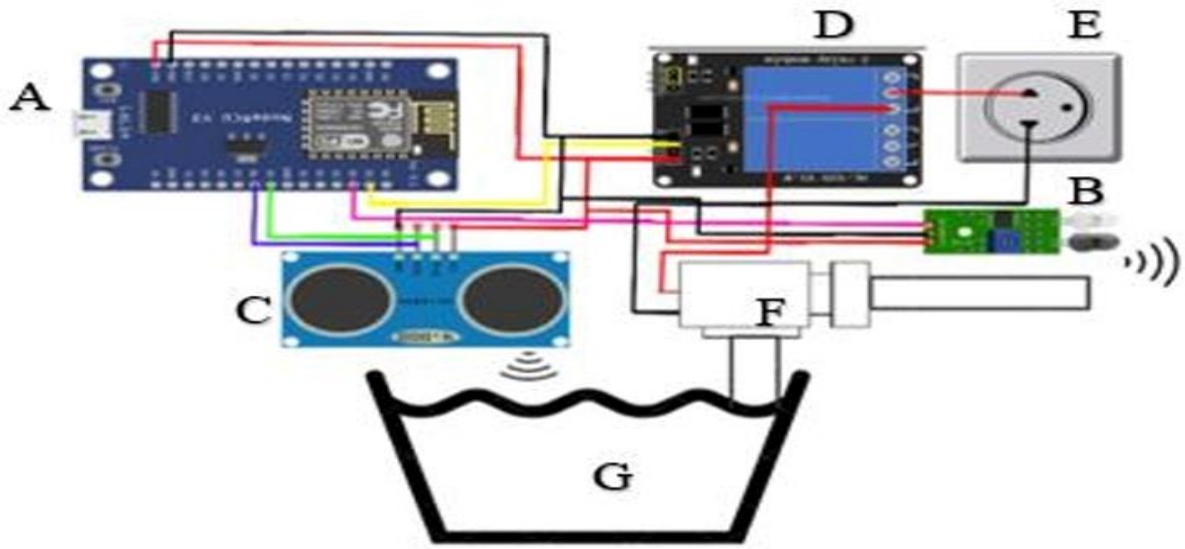
Operating time: 10msec Release time: 5msec

Maximum switching: 300 operating/minute (mechanically)

FLOWCHART FOR SMART FAUCET SYSTEM:



OVERALL SERIES OF TOOLS:



WORKING OF THE SYSTEM:

The Concept behind the Smart Tap System is very simple. I will use a HCSR04 Ultrasonic Sensor to check if any object such that the glass is placed before the tap (dispenser). A solenoid valve will be used to control the flow of water, which is when energised the water will flow out and when de-energised the water will be stopped. So I will write a python program which always checks if any object is placed near the tap, if yes then the solenoid will be turned on and wait till the object is removed, once the object is removed the solenoid will turn off automatically thus closing the supply of water. The solenoid valve used in this project is a 12V valve with a maximum current rating of 1.2A and a continuous current rating of 700mA. That is when the Valve is turned on it will consume about 700mA to keep the valve turned on. As we know an Arduino is a Development board which operates with 5V and hence we need a switching driver circuit for the Solenoid to turn it on and off. The Ultrasonic Sensor is powered by the +5V and ground pins of the GPIO pin. The Echo and Trigger pin is connected to the GPIO pin 8 and pin 9 respectively. I can then program the Raspberry pi to use the Ultrasonic sensor to measure the distance and turn on the MOSFET when an object is detect. The whole circuit is simple and hence can be easily build on top of a breadboard.

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