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Smart Water Management Using IOT

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Abstract:

Water is a significant resource for life and its management is a key issue. Now-a-days, information and communications systems for water control are facing inter-operability problems due to the lack of support of standardization in monitory and control equipment. This paper "Smart Water Management using Internet of Things (IoT)" focuses on reducing the water wastage by using smart water management using Arduino Uno and Node MCU. It discusses how Internet of Things (IoT) can be used to continuously monitor the water level. It also discusses how water supply can be maintained using the proposed system.

Keywords

Arduino Uno, Internet-of-things, Inter-operability, Node MCU.

1. Introduction

Sustainability of available water resource in many regions of the word is now a dominant issue. This problem is related to poor water allocation, inefficient use, and lack of adequate and integrated water management. Water is commonly used for agriculture, industry, and domestic consumption. Therefore, efficient use and water monitoring are potential constraints for home or office water management system. Last few decades several monitoring systems integrated with water level detection have become accepted. Measuring water level is an essential task for government and residence perspective. In this way, it would be possible to track the actual implementation of such initiatives with integration of various controlling activities. Therefore, water controlling system implementation makes potential significance in home applications.

The existing automated method of level detection is described and that can be used to make a device on/off. Moreover, the common method of level control for home appliance is simply to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank. This is not properly supported for adequate controlling system. Besides this, liquid level control systems are widely used for monitoring of liquid levels, reservoirs, silos, and dams etc. Usually, this kind of systems provides visual multi-level as well as continuous level indication. Audio visual alarms at desired levels and automatic control of pumps based on user's requirements can be included in this management system. Proper monitoring is needed to ensure water sustainability is actually being reached, with disbursement linked to sensing and automation. Such programmatic approach entails Smart Water Management using IOT.

This paper is organized in the following ways. Chapter two concentrates on the basic concepts of the system design. Design and Implementation part is described in chapter Three. Chapter Four deals with the conclusion and future works.

2. Basic Concepts

The technique of water level monitoring and controlling system involves some basic parts which are softly aggregated together in our proposed block diagram (see figure 1).

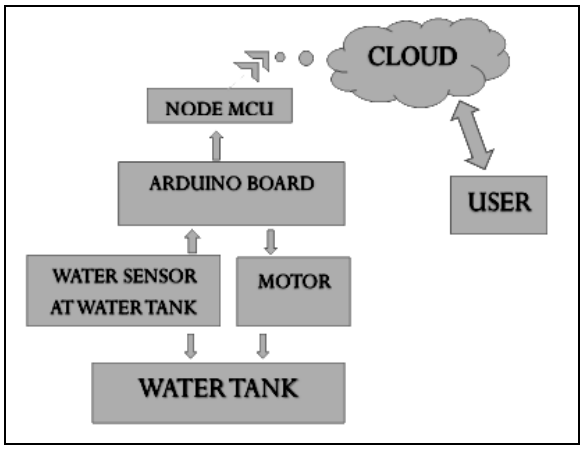

Figure 1. Block diagram of proposed system

2.1. Arduino Board

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on computer, used to write and upload computer code to the physical board.

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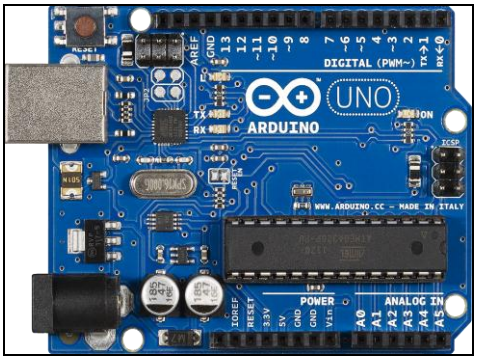

Figure 2. Arduino UNO board

The Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board (see figure 2). Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

2.2. Node MCU

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module (see figure 3). The term "Node MCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs

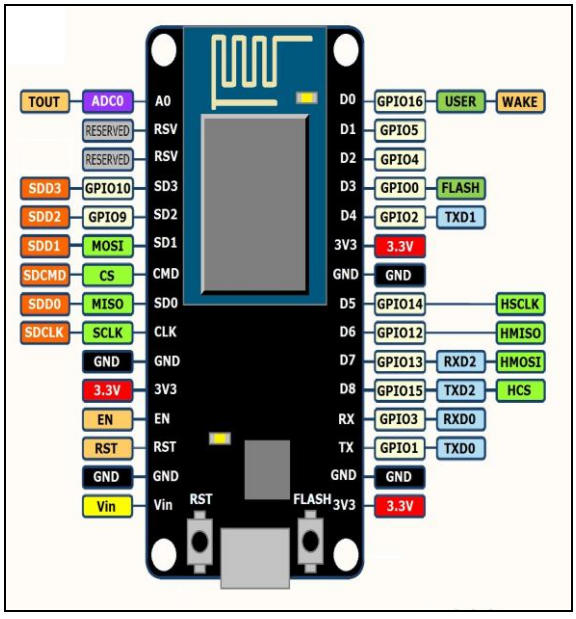

Figure 3. Node MCU.

2.3. Internet-Of-Things (IoT)

It is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers. The ability to transfer data over a network without requiring human-to-human or human-to-computer interaction can be achieved.

The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. The list of main benefits of providing IoT in water management scenarios:

a) *Efficiency increase*: water management companies and associations can use real-time operational control to make smarter business decisions and reduce operating costs. They use real-time data from sensors and actuators to monitor and improve water management infrastructures, making them more efficient, reducing energy costs and minimizing man intervention.

b) *Productivity increase:* Productivity is a critical parameter that affects the profitability of any organization. IoT allows real-time control, new business models, process optimization, resource-conservations, service time reduction, and the capability to do all of this globally, reducing the mismatch of required vs. available skills and improving labor efficiency.

c) *Internet-oriented:* The proposed model communicates with two interfaces (user end & water tank reserve end) enabling the definition of a flexible and scalable communication system for controlling the huge amount of subsystems to be required for a complete water management system.

2.4. Water Level Sensor

Water level sensor (see figure 4) is used to indicate the level of water in overhead tank, by using this we can avoid the overflow of water, and at any time we can know the level of water in tank, it has a simple circuit.

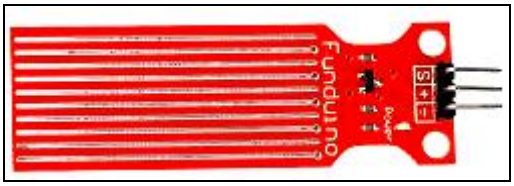

Figure 4. Water level sensor

The connection of Arduino with Water level sensor is shown below (see figure 5)

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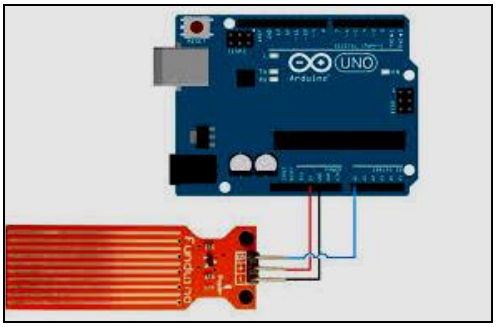

Figure 5. Connection of sensor with Arduino.

3. Design and Implementation.

At the first stage of design, a water level sensor is been made for sensing water level accurately. Arduino board is used to control the overall system automatically that reduces the design and control complexity. Arduino takes input from the sensor unit which senses the water level through sensor. After that the data is transmitted to User through node MCU which is connected to internet. The Temboo website will send message to user and reply from user decides the water pump's action (on/off) with respect to current water status of the tank. The whole design flow chart is shown in figure 6. We used Arduino IDE for writing Arduino programs.

3.1. Programming Steps for Arduino Board

I. Connect Arduino to the USB port of computer.
II. Set the board type and the serial port in the Arduino Programmer.
III. An Arduino sketch usually has five parts: a header describing the sketch and its author; a section defining variables; a setup routine that sets the initial conditions of variables and runs preliminary code; a loop routine, which is where you add the main code that will execute repeatedly until you stop running the sketch; and a section where you can list other functions that activate during the setup and loop routines.
IV. Test the microcontroller by using one of the preloaded programs, called sketches, in the Arduino Programmer.
V. After uploading the new sketch to Arduino, disconnect it from computer and integrate it into proposed project as directed.
VI. When a program is compiled it is translated from the code that you wrote into a new code called hex code.

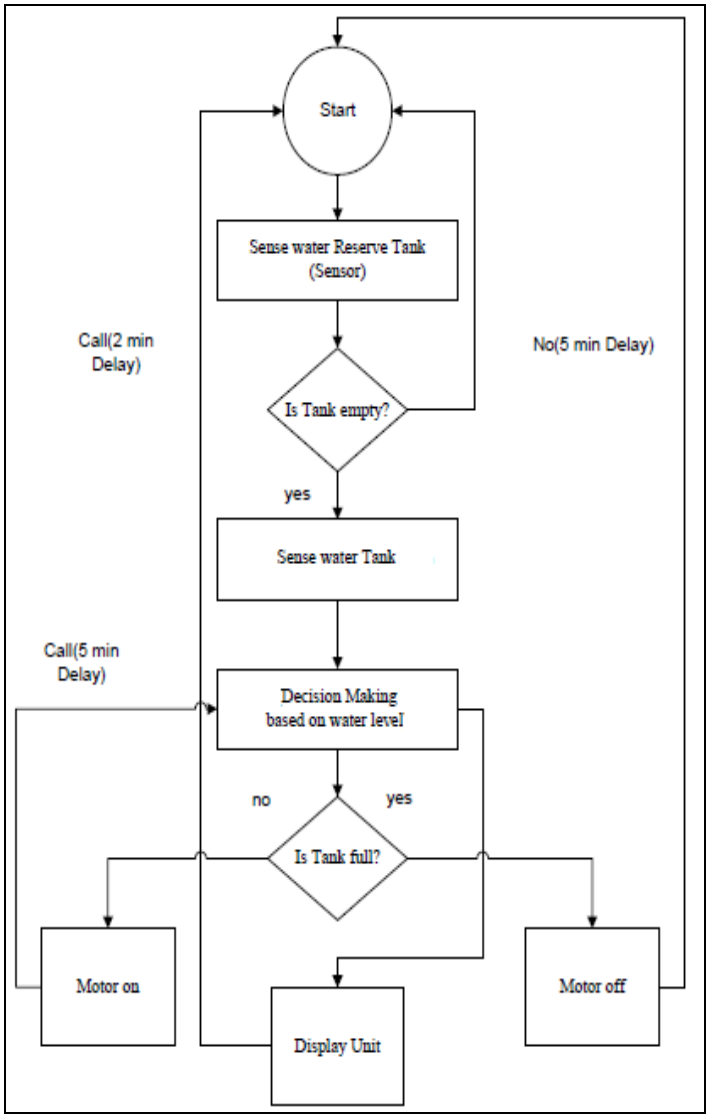

Figure 6. Design Flow of Proposed System

3.2. Connecting Arduino with Node MCU

The Arduino is connected to Node MCU in order send messages to user through Temboo website which can be considered as Cloud. The Connection can see in the figure 7 below. The Node MCU programming model is similar to that of Node.js, only in Lua.

It is asynchronous and event-driven. Many functions have parameters for callback functions. The Node MCU acts like webserver to connect with the cloud which makes Internet of things possible in turn increases the interoperability and High standardization for the proposed project. Node MCU ESP-12E development board can be connected to 5Vusing micro USB connector or Vin pin available on board. The ESP8266 chip requires 3.3V power supply voltage. It should not be powered with 5 volts like other Arduino boards

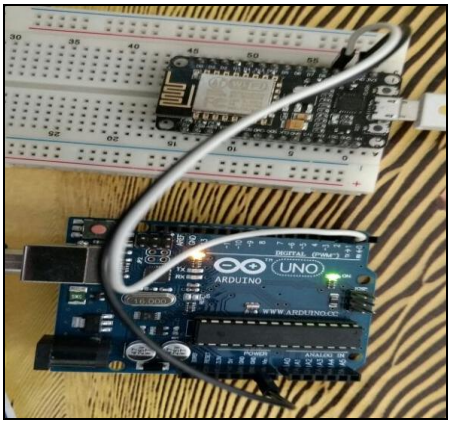

Figure 7. Connecting Arduino with Node MCU

Figure 8. Testing Water Level sensor

Figure 9. Proposed Prototype

4. Conclusions and Future Work

Water is one of the most important basic needs for all living beings. But unfortunately a huge amount of water is being wasted by uncontrolled use. Existing water level monitoring systems have many practical limitations.

We tried to implement an efficient automated water level monitoring and controlling system to overcome such problems. Our intention of this research work was to establish a flexible, economical and easy configurable system which can solve the problems of water loss. We have been used a low cost Arduino in this system which is the key point to reduce cost. We have successfully implemented the system in lab and therefore proposed a Smart Water Management Using IOT whose flexibility would offer us to control this system from any place via cloud and even with different type of devices. The proposed work could have a substantial benefit of efficient water management. The snapshot of result is shown in figure 9.

Future work will focus on the contribution to solve coordination problems when executing multiple ways over the same physical resources, considering priority and conditional executions and also process optimization.

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