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SOLAR POWERED SMART WATER MONITORING SYSTEM BASED ON IOT

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ABSTRACT
This study presents an Internet of Things (IoT)-based solar-powered smart water monitoring system. Water is an abundant and critical natural resource that is necessary for human survival. Maintaining clean water is essential for public health since contaminated water sources are the source of numerous diseases that kill millions of people each year. The purpose of this study is to evaluate the Melor River in Kelantan's water quality and create an Internet of Things (IoT) water quality monitoring system that runs on solar power. Three sensors—turbidity, total dissolved solids (TDS), and temperature—are powered by a solar array that is part of the system. A microprocessor and sensors provide real-time data on water parameters to a central data center. Using IoT development, a Blynk application on cellphones facilitates water quality monitoring.

Keywords:
2 Turbidity Sensors, Microcontroller

INTRODUCTION

A specialized computing device created to carry out a particular purpose is called an embedded system. Air conditioners, VHS and DVD players, printers, fax machines, and cell phones are a few examples of appliances. These devices are all equipped with a CPU, specially designed hardware for that purpose, and embedded software, sometimes referred to as "firmware," which is run by the processor in order to carry out that purpose. Unlike general-purpose computers such as laptops or desktops, embedded systems are designed to perform specific tasks cannot be reprogrammed to perform multiple jobs since they are committed to specific duties. Embedded systems frequently lack secondary storage devices like CD-ROMs or floppy drives and have constrained resources, especially when it comes to memory.

OBJECTIVES

Industrial automation: Embedded systems are widely employed for duties like monitoring and controlling temperature, pressure, and other parameters in sectors like pharmaceuticals, cement, sugar, oil exploration, and electricity generation.
Medical electronics: Almost all hospital medical equipment, such as blood pressure monitors, X-ray scanners, ECG and EEG machines, and imaging and blood analysis equipment.
Computer networking: The implementation of data communication protocols and the facilitation of network interconnection using networking hardware such as routers, bridges, switches, and protocols including ISDN, ATM, X.25, and frame relay switches.
Wireless Technologies: Developments in mobile communications are opening up a wide range of fascinating embedded system applications. One of the greatest inventions of the last ten years of the twentieth century is the cell phone. This incredibly strong embedded system allows voice communication while we're moving. These days, multimedia services over the Internet can be accessed by both palmtop computers and PDAs. Strong embedded systems are also found in mobile communication infrastructure, such as base station controllers and mobile switching centers.

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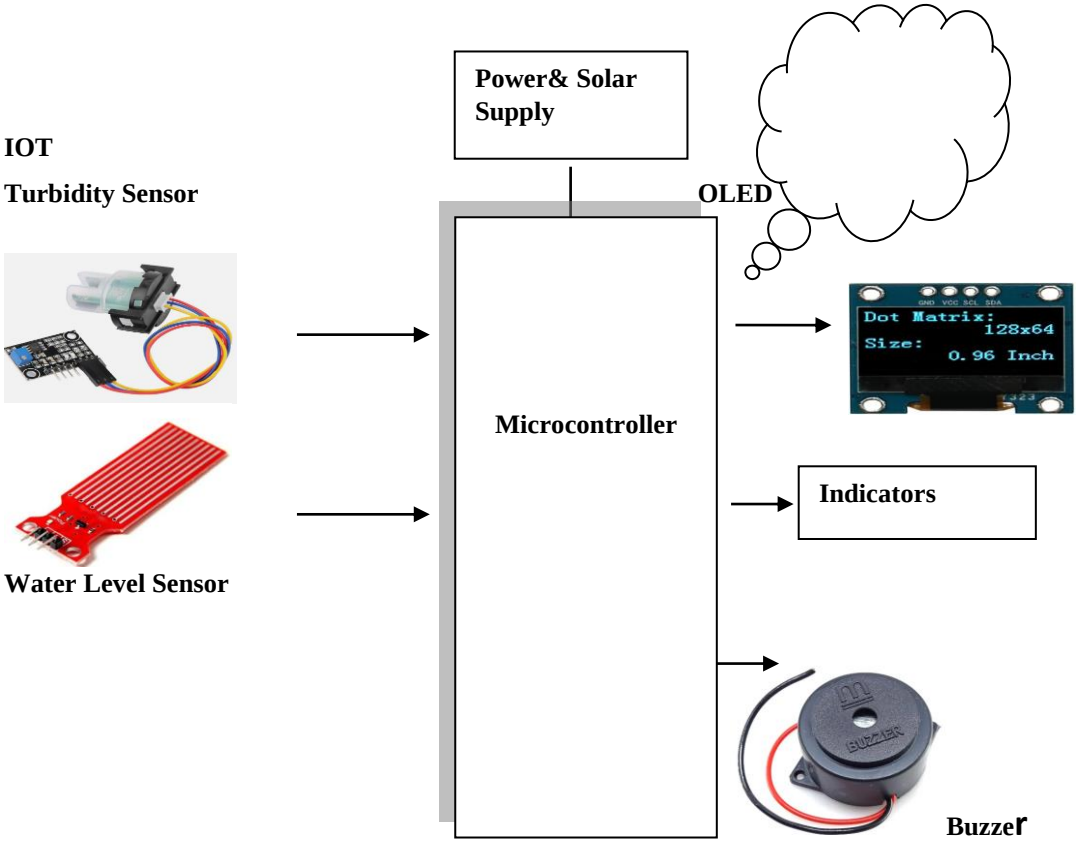
Voltage Regulator: A regulator circuit is used to eliminate any last ripples and fluctuations in the DC voltage. This regulator makes sure that even in the event that the input voltage varies or the load linked to the output changes, the output voltage stays constant at +5V. For this, LM7805 and other voltage regulator integrated circuits (ICs) are frequently utilized.

METHODOLOGY

A solar power supply module, a sensing module, and a master control module are commonly found in solar-powered smart water monitoring systems. A solar panel and a solar power management module are part of the solar power supply module. The pH, temperature, conductivity, turbidity, and other characteristics of the water quality are all measured by the sensors in the sensing module. A CPU, an OLED screen display, and a data remote transmission unit are all part of the master control module..

BLOCK DIAGRAM:



RPi Pico & Pico W PWM Pinout:

The RP2040 in Raspberry Pi Pico has 8 identical slices of PWM block. Each slice can monitor the frequency or duty cycle of an input signal as well as produce two PWM output signals. So, there are 16 controllable PWM outputs. The PWM block may operate each of the 26 available GPIO pins onboard the Raspberry Pi Pico. A PWM channel may control multiple GPIOs. The table below shows how the PWM channels relates to the GPIOs.

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PWM Channel	GPIO
0A	GPIO 0, GPIO 16
0B	GPIO 1, GPIO 17
1A	GPIO 2, GPIO 18
1B	GPIO 3, GPIO 19
2A	GPIO 4, GPIO 20
2B	GPIO 5, GPIO 21
3A	GPIO 6, GPIO 22
3B	GPIO 7
4A	GPIO 8
4B	GPIO 9
5A	GPIO 10, GPIO 26
5B	GPIO 11, GPIO 27
6A	GPIO 12, GPIO 28
6B	GPIO 13
7A	GPIO 14
7B	GPIO 15

Table 1. RPi Pico W PWM Pinout

Table 2.Special Function Pins in RPi Pico

Pin	Function
GPIO23	Controls the on-board SMPS power save pin.
GPIO24	Senses voltage at VBUS pin – high if VBUS is present, else low.
GPIO25	Connected to onboard LED.
GPIO29	Used in ADC mode (ADC3) to measure VSYS/3.

RESULTS AND DISCUSSION

Numerous aspects of water quality, including pH, temperature, dissolved oxygen, and the existence of chemicals and bacteria, are measured by IoT sensors. These sensors are suitable for installation in lakes, rivers, and other bodies of water. They can send real-time data to a central monitoring system.

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CONCLUSION

The research describes a unique IoT-based method for monitoring water quality that uses solar power for data transfer to a cloud server and turbidity result presentation. The study shows through experiments that the device can operate for 36 hours by using solar energy to recharge its battery. The article also states that the water quality monitoring system has a very small margin of error—less than 5%. This creative design provides an accurate and long-lasting way to evaluate water quality in a variety of environmental conditions.

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