

IOT Based Digital Notice Board Using Raspberry PI with Voice Notification

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Abstract : The system comprises a Raspberry Pi as the central processing unit, connected to a display screen and speakers. It utilizes Python programming to manage both the display and voice output. The information to be displayed and announced can be updated remotely through a user-friendly web interface built with Flask, a lightweight Python web framework. Users can access this interface from any device connected to the same network, allowing them to input text that will be displayed on the screen and converted into speech using text-to-speech (TTS) technology. The notice board fetches the latest messages from the server periodically and updates the display accordingly. Additionally, it uses TTS to provide voice notifications for new messages, ensuring that the information reaches a wider audience, including visually impaired individuals. The TTS functionality is powered by an open-source library, such as pyttsx3, which provides flexible and high-quality voice synthesis. This project highlights the integration of IoT with digital communication tools to create a versatile and accessible information system. It demonstrates the practical application of a Raspberry Pi in IoT projects, showcasing its capability to handle multiple tasks, including web server management, display control, and audio output. The implementation of voice notifications adds an inclusive aspect to the system, making it more user-friendly and effective

Introduction

The primary benefits of IoT-based digital notice boards include real-time updates, allowing information to be instantly refreshed from any location; remote management, enabling administrators to control multiple boards from a centralized device; and the ability to display dynamic content such as text, images, videos, and live feeds. These boards are cost-effective and eco-friendly, reducing the reliance on paper and printing, and also offer scheduled content updates for timely information dissemination. They find applications in various settings: educational institutions for announcements and emergency alerts, corporate offices for company news and meeting schedules, public spaces for public service announcements and advertisements, and smart cities for providing citizens with real-time information. However, implementing IoT-based digital notice boards comes with challenges such as ensuring

security against cyber threats, maintaining reliability and consistent performance, designing for scalability to handle numerous devices and large data volumes, and balancing initial setup costs with long-term benefits. Despite these challenges, IoT-based digital notice boards significantly enhance communication efficiency and interactivity, offering a robust solution for modern information dissemination needs in our increasingly connected world.

Literature Review:

Solar Based Charging Station for E-Vehicle

The development of IoT-based digital notice boards has garnered significant attention in recent years, reflecting the broader trend of digitization and smart technology integration in various domains. This literature review examines existing research and technological advancements related to IoT-based digital notice boards, highlighting key contributions, challenges, and opportunities for future work.

Early Developments and Basic Implementations

Early implementations of digital notice boards primarily focused on basic functionality, replacing traditional bulletin boards with digital screens. These systems used simple content management software to display static images or text. For example, studies by Wang et al. (2015) explored the use of LCD screens in educational settings to improve the dissemination of information and reduce paper usage. However, these systems lacked real-time update capabilities and remote management features, limiting their effectiveness and scalability.

Integration of IoT and Advanced Features

With the advent of IoT technology, digital notice boards have evolved significantly. IoT integration allows for remote content management, real-time updates, and dynamic content display. According to Gupta et al. (2017), IoT-enabled notice boards can receive updates via cloud servers, enabling administrators to manage multiple boards from a central location. This development addresses the limitations of earlier systems by enhancing flexibility and operational efficiency.

Research by Sharma and Singh (2018) delves into the use of microcontrollers like Arduino and Raspberry Pi in IoT-based notice boards. These studies highlight the importance of selecting appropriate hardware to ensure reliability and ease of integration with existing IT infrastructure. connectivity further enhances the system's robustness, allowing it to function effectively in various environment

Moreover, IoT-based digital notice boards support dynamic content, including text, images, videos, and live feeds, making the information more engaging and impactful. This flexibility allows for a richer and more interactive communication experience compared to traditional notice boards. Additionally, these digital systems contribute to environmental sustainability by reducing the need for paper and printing resources, thereby minimizing waste and promoting eco-friendly practices.

This system ensures secure, real-time updates and can be enhanced by adding features like mobile app integration, support for multiple displays, real-time notifications, and multimedia content. This modern solution improves information dissemination efficiency and scalability.

Proposed System

On the software side, a web or mobile application allows users to create, edit, and publish notices easily. This application communicates with a backend server responsible for data storage, user authentication, and coordinating updates to the display units. The microcontroller runs firmware that manages the display and ensures seamless communication with the server. For efficient and reliable communication between the application and the display units, protocols like MQTT (Message Queuing Telemetry Transport) are commonly used. This system offers a flexible and efficient solution for disseminating information in various settings, such as schools, businesses, and public places, enabling real-time updates and reducing the need for manual intervention.

Block Diagram

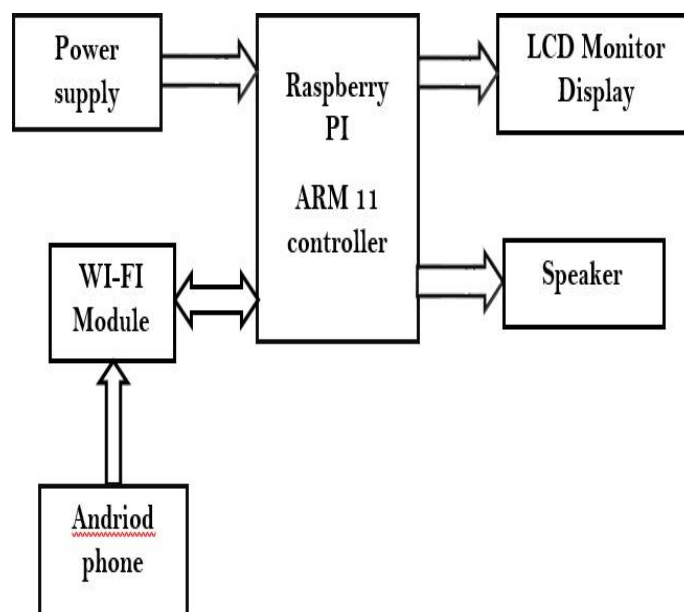


Fig 1- block diagram of solar based station digital E fuel monitoring

Hardware Components:

POWER SUPPLY

The power supply section is the section which provides +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 the 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.

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.

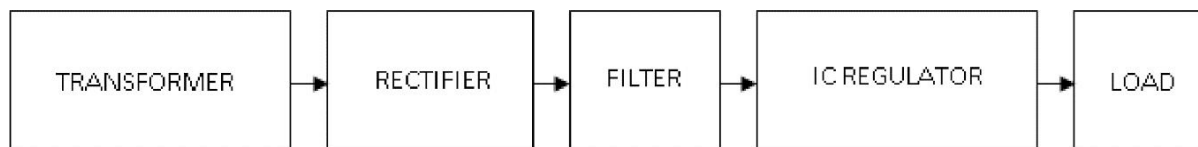


Figure 5.1 : Block Diagram of Power Supply

Transformer

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in India) to a safer low voltage.

The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. Transformers waste very little power so the power out is (almost)

equal to the power in. Note that as voltage is stepped down current is stepped up.

The transformer will step down the power supply voltage (0-230V) to (0- 6V) level. Then the secondary of the potential transformer will be connected to the bridge rectifier, which is constructed with the help of PN junction diodes. The advantages of using a bridge rectifier are it will give peak voltage output as DC.

Rectifier

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC

Bridge Rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4.

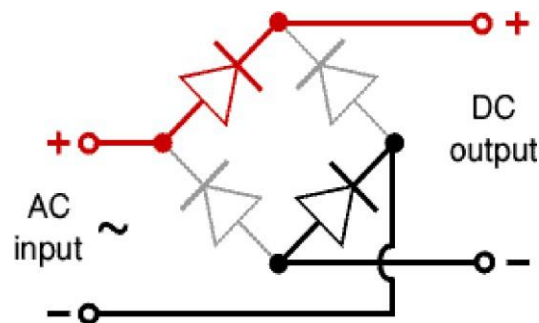


Figure 5.2 : Bridge Rectifier

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given

transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

The main advantage of this bridge circuit is that it does not require a special centre tapped transformer, thereby reducing its size and cost.

The single secondary winding is connected to one side of the diode bridge network and the load to the other. The result is still a pulsating direct current but with double the frequency.

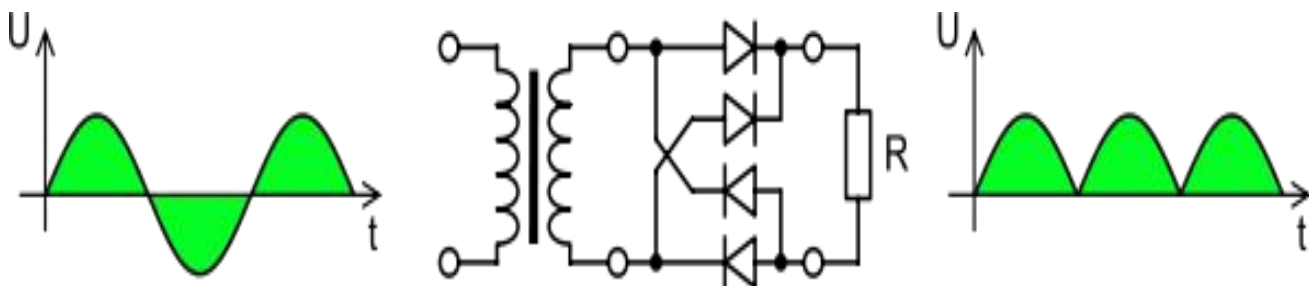


Figure 5.3 : Output Waveform of DC

Smoothing

Smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

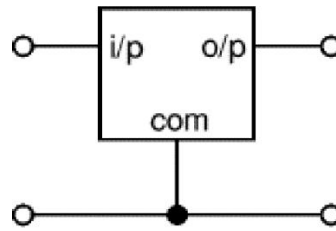
Voltage Regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustable set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

A fixed three-terminal voltage regulator has an unregulated dc input voltage, V_i , applied to one input terminal, a regulated dc output voltage, V_o , from a second terminal, with the third terminal connected to ground.

The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the

series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts. Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection'). Many of the fixed voltage regulator ICs have 3 leads and look like power transistors, such as the 7805 +5V 1Amp regulator. They include a hole for attaching a heat sink if necessary.

**Figure 5.4 : Regulator**

Electronic Transformer

Electronic transformers employ semiconductor devices to convert alternating current (AC) voltage levels efficiently. Unlike traditional electromagnetic transformers, they utilize rectification to convert AC to pulsating DC. Subsequently, high-frequency switching techniques, like pulse-width modulation (PWM), transform the DC voltage to the desired output level. These transformers may include isolation components for safety and noise reduction, such as optocouplers or transformer-based stages. Additionally, output filtering using capacitors eliminates residual AC components and switching noise. Voltage regulation circuitry ensures a stable output voltage, even amid varying input voltages or load conditions. Commonly found in power supplies for electronics, lighting systems, and industrial machinery, electronic transformers offer advantages like smaller size, lighter weight, and potentially higher efficiency than their electromagnetic counterparts.

**Figure 5.5 : Electronic Transformer**

5.2 MICROPROCESSOR

Raspberry Pi is a series of small single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. Raspberry Pi is an ARM based credit card sized SBC (Single Board Computer) created by Raspberry Pi Foundation. Raspberry Pi runs Debian

based GNU/Linux operating system Raspberry Pi OS and ports of many other OSes exist for this SBC.

Raspberry Pi 3 Model B+ was launched with a faster 1.4 GHz processor, a three-times faster gigabit Ethernet (throughput limited to ca. 300 Mbit/s by the internal USB 2.0 connection), and 2.4 / 5 GHz dual-band 802.11ac Wi-Fi (100 Mbit/s).[26] Other features are Power over Ethernet (PoE) (with the add-on PoE HAT), USB boot and network boot (an SD card is no longer required).



Figure 5.6 : Raspberry Pi

Result





Fig 8-Hardware kit

Result:

The result of a solar-based station digital e-fuel monitoring system for automobiles is the ability to accurately monitor the fuel level and battery level of a vehicle, and to alert the driver when the fuel level is low. This system can provide a more accurate and reliable way to monitor fuel levels compared to traditional methods, such as manually checking the fuel gauge. Additionally, the use of solar power as a renewable energy source can reduce the reliance on grid power and help to reduce the carbon footprint of the vehicle. The digital display unit provides an easy-to-read display of the fuel and battery levels, making it easy for the driver to monitor and maintain the vehicle.

Overall, the result of a solar-based station digital e-fuel monitoring system for automobiles is improved efficiency, reduced costs, and a more sustainable way to monitor and maintain vehicles.

Conclusion:

An IoT-based digital notice board with noise notification is a powerful tool offering efficient communication and environment management. By integrating IoT technology, it ensures real-time updates and announcements, enhancing communication effectiveness in busy environments. The noise notification feature adds value by alerting users when noise levels surpass acceptable limits, fostering a conducive atmosphere for learning or work. This combination improves productivity by maintaining a disciplined environment. In educational institutions, it aids in creating focused learning spaces, while in offices, it promotes productivity by minimizing distractions. Moreover, in public spaces, it helps manage noise pollution, contributing to a better quality of life. Overall, this solution optimizes communication,

productivity, and environmental awareness, making it a valuable addition to various settings.

FUTURE SCOPE

AI Integration: Integration of artificial intelligence (AI) algorithms can enhance noise detection capabilities, improve notification accuracy, and automate system adjustments based on usage patterns and environmental factors.

Smart Sensors: Advancements in sensor technology, such as more sensitive and energy-efficient noise sensors, can improve the system's performance and reliability while reducing maintenance requirements.

Predictive Analytics: Implementing predictive analytics can anticipate noise trends, identify potential issues, and proactively adjust notification thresholds or schedule maintenance, optimizing system efficiency.

Edge Computing: Utilizing edge computing capabilities can process data locally on IoT devices, reducing latency, enhancing real-time responsiveness, and improving overall system performance.

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