MCU Alarm Clock Product Brief

Overview

The MCU Alarm Clock is a compact, fully functional digital alarm clock built around a low-cost microcontroller unit (MCU). It offers essential timekeeping features, intuitive user controls, and a clear LED display housed in a sleek, 3D-printed enclosure. Designed for everyday users, it provides reliability and simplicity without the distractions or complexity of modern smart devices.

Core Features

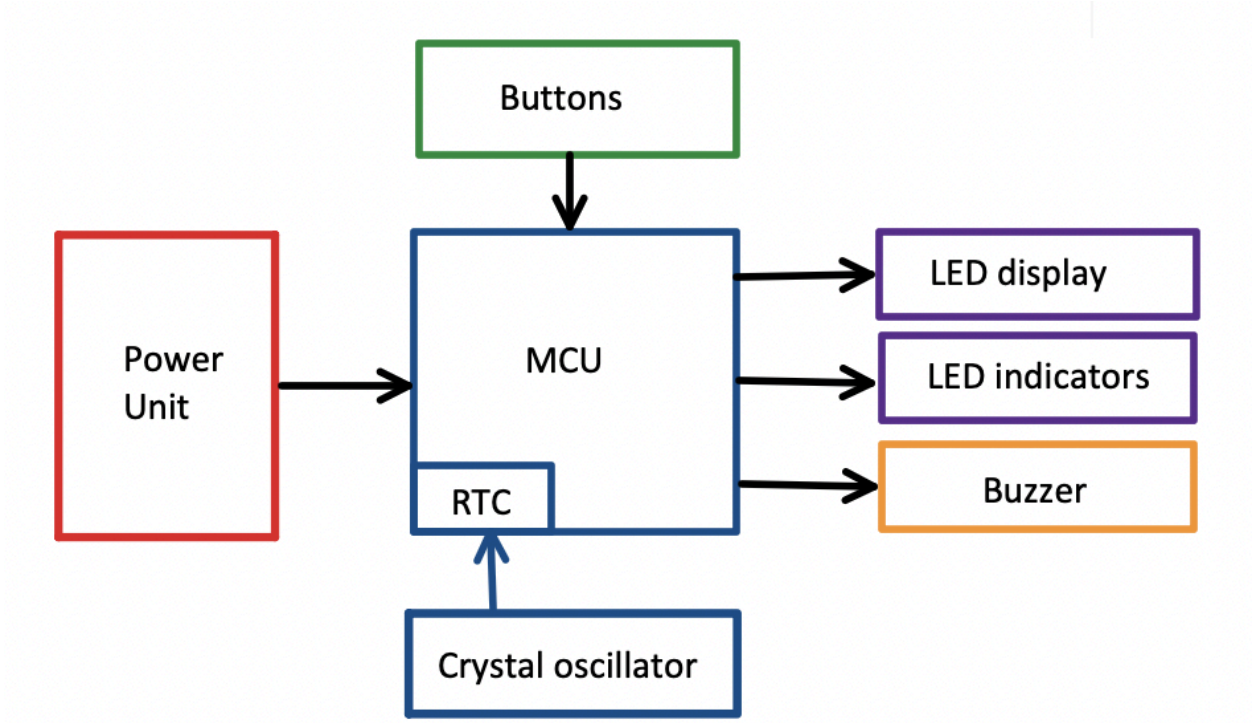
The MCU Alarm Clock includes the following features:

- **Digital Time Display**
  A clear 4-digit, 7-segment LED display provides HH:MM readout, with additional “PM” and “Alarm On” LED indicators.
- **Convenient User Controls**

Five responsive tactile buttons allow for easy time and alarm setting and snooze functionality. A dedicated switch toggles the alarm state.

- **Alarm Functionality**
  An audible buzzer activates when the alarm time is reached. A snooze button postpones the alarm by nine minutes after pressing.
- **Power Management:**
  Powered via USB-C with battery backup support. Includes an LED charging indicator and a power switch for on/off control.

Design Overview



The MCU alarm clock design connects a low-power 32-bit microcontroller to a power unit and a set of peripherals. The microcontroller uses a built-in real-time clock (RTC) module to keep accurate time. A precision external crystal oscillator provides a stable clock source for the RTC, enhancing long-term accuracy.

For the power system, a USB-C female socket supplies the main input voltage, which is regulated and distributed to the MCU and backup battery. Additionally, the power system

includes an LED to indicate power/charging state and a physical switch to power the clock on or off.

The 4-digit, 7-segment LED display is driven via GPIO and supports either a common-cathode or common-anode configuration, requiring 13 GPIO output pins. Two additional GPIO pins are used for the “PM” and “Alarm On” indicators.

A total of 6 GPIO input pins are allocated for five pushbuttons and one switch. The buttons and their functions are:

- *Set Clock*: Hold while pressing *Hour Increment* or *Min Increment* to adjust the time.
- *Set Alarm*: Hold while pressing *Hour Increment* or *Minute Increment* to set the alarm.
- *Hour Increment*: Increases the hour when used with *Set Clock* or *Set Alarm*.
- *Minute Increment*: Increases the minute when used with *Set Clock* or *Set Alarm*.
- *Snooze*: Activates a 9-minute delay when pressed during an active alarm.
- *Alarm Toggle*:Turns the alarm functionality on or off.

A GPIO output pin is used to control a buzzer. The buzzer sounds when the clock time matches the alarm time and is silenced only by pressing the snooze button, turning off the alarm, or powering down the device.