**Dr. Babasaheb Ambedkar Technological University, Lonere**



Mini Project report

on

**“SMART EXTENSION BOX”**

Submitted by

**Darshan Rathod**

Submitted in partial fulfillment of the requirement for the completion of

B. Tech. in Electronics & Telecommunication Engineering

**Deogiri Institute of Engineering and Management Studies, Chh. Sambhajinagar**

**Department of Electronics & Telecommunication** **Engineering**

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**CERTIFICATE**

This is to certify that the Mini project report entitled

**“Smart Extension Box”**

Submitted by

**Darshan Rathod**

**EC3239**

Has completed as per the requirements of

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**EC3239**

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1. **Introduction**

1.1 Project Overview

* + 1. Objectives

The primary objectives of the Smart Extension Box project are multifaceted, aiming to provide users with a comprehensive solution for controlling electrical devices.

* Manual Control:

- Implement a user-friendly manual control system using physical switches.

- Enable users to have direct and immediate control over connected devices.

* Bluetooth Functionality:

- Facilitate remote device control through Bluetooth communication.

- Offer users the flexibility to manage devices from a distance, enhancing convenience.

* Timer Feature:

- Incorporate a timer functionality for scheduling device activation and deactivation.

- Provide users with the ability to automate device control based on predefined intervals.

* + 1. Components Used
* Microcontroller: AT89S5

- Central processing unit for managing communication and device control.

* Bluetooth Module: HC-05

- Facilitates remote control via Bluetooth communication.

* Relays: Two relays for controlling electrical devices.

- Enables the on/off switching of connected devices.

* LED Indicators: Visual feedback for relay states and timer operation.

- Enhances user awareness of device states and timer activity.

* Manual Switches: Physical buttons for manual control.

- Provides users with direct and immediate control over device states.

* Power Supply: 5V, 500mA from a mobile charger adapter.

- Ensures a stable power source for the system's operation.

* + 1. System Architecture
* Microcontroller-Centric Design:

- AT89S51 microcontroller serves as the brain of the system.

- Manages communication with Bluetooth module, relay control, and timer functionality.

* Bluetooth Integration:

- HC-05 module enables wireless communication, allowing users to control devices remotely.

* Relay Control:

- Two relays (Relay1 and Relay2) control the on/off states of connected devices.

* LED Indicators:

- LED indicators (LED1, LED2, TLED) provide visual feedback on device states and timer activity.

* Power Supply:

- Stable 5V, 500mA power supplied from a mobile charger adapter.

1. **Literature Review**

Wipro Smart USB Extension| Voice control with Alexa and Google Home|

* 1. Features
* Control from Anywhere: Control the camera from anywhere with the Wipro Next Smart Home app, and ensure 100% safety of your home and loved ones.
* Scheduling: Turn your device ON/OFF at pre set times as per your convenience. Each socket can be scheduled individually by using the Wipro Smart Home App.
* Voice Control: Control the Smart camera through voice with Amazon Alexa and Google Assistant.
* Auto Cut-Off: Stay safe with the Auto Cut-off feature. The smart extension board cuts off the power supply if there are any fluctuations in voltage  or current, there by protecting the devices from failure.
* Energy Monitoring: Have a complete control on your electricity bill by tracking the energy consumed by each device connected to the smart socket.
  1. Drawbacks
* No manual control.
* Requires WiFi connectivity for voice control
* Uses powerful processor

1. **System Development**
   1. Hardware Components

The development of the Smart Extension Box involves carefully selecting and integrating various hardware components. These components collectively form the foundation of the system, ensuring smooth communication, control, and user interaction.

* Microcontroller (AT89S51):

- Central processing unit managing communication, control, and timer functionality.

- Connects to Bluetooth module, relays, LED indicators, and manual switches.

- 4K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 1000 Write/Erase Cycles

- 4.0V to 5.5V Operating Range • Fully Static Operation: 0 Hz to 33 MHz

- Three-level Program Memory Lock

- 128 x 8-bit Internal RAM

- 32 Programmable I/O Lines

- Two 16-bit Timer/Counters

- Six Interrupt Sources

- Full Duplex UART Serial Channel

- Low-power Idle and Power-down Modes

- Interrupt Recovery from Power-down Mode

- Watchdog Timer

- Dual Data Pointer

- Power-off Flag

- Fast Programming Time

- Flexible ISP Programming (Byte and Page Mode)

* Bluetooth Module (HC-05):

- Facilitates wireless communication for remote device control.

- Interfaces with the microcontroller for data exchange.

Software features

- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has. Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.

- Given a rising pulse in PIO0, device will be disconnected. λ Status instruction port PIO1: low-disconnected, high-connected;

- PIO10 and PIO11 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.

- Auto-connect to the last device on power as default.

- Permit pairing device to connect as default.

- Auto-pairing PINCODE:”0000” as default

- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.

* Relays and Device Control:

- Two relays (Relay1 and Relay2) control the on/off states of connected devices.

- Relay activation is synchronized with manual switches and Bluetooth commands.

* LED Indicators:

- LED indicators (LED1, LED2, TLED) provide visual feedback on relay states and timer activity.

- Enhance user awareness of device states and timer operations.

* Manual Switches:

- Physical button for manual control of connected devices.

- Directly interface with the microcontroller to trigger device states.

* Power Supply:

- Stable 5V, 500mA power supplied from a mobile charger adapter.

- Ensures a reliable and continuous power source for the system.

* 1. Software Implementation

The software development for the Smart Extension Box involves coding the microcontroller to manage communication, process user inputs, and control connected devices. The code structure is designed to accommodate manual control, Bluetooth functionality, and timer features.

* UART Communication (Bluetooth Integration):

- Implement UART communication for seamless interaction with the HC-05 Bluetooth module.

- Ensure the microcontroller can send and receive data, enabling remote device control.

UART (Universal Asynchronous Receiver-Transmitter) communication stands as a fundamental and widely adopted serial protocol in electronic systems, facilitating seamless data exchange between microcontrollers, sensors, and various embedded devices. Unlike synchronous protocols, UART operates asynchronously, allowing devices to communicate without a shared clock signal. This asynchronicity is achieved by agreeing upon a common baud rate, dictating the speed at which bits are transmitted per second. The communication involves two lines: Transmit (Tx) for sending data and Receive (Rx) for receiving it.

UART communication supports both half-duplex and full-duplex modes, enabling either one-way communication at a time or simultaneous two-way communication. While UART itself lacks inherent error-checking mechanisms, higher-level protocols like Modbus or ASCII can be implemented to enhance reliability. In practical applications, UART finds its utility in short-distance communications, linking microcontrollers, sensors, and peripherals like GPS modules and Bluetooth devices. Its simplicity, efficiency, and versatility make it a cornerstone in the realm of serial communication for a broad spectrum of electronic projects.

* Timer Functionality:

- Developed timer functionality using Timer 0 interrupts.

- Establish precise control over time intervals, allowing users to schedule device operations.

Microcontrollers like AT89C51 feature dedicated timers such as Timer0 and Timer1, essential for precise timekeeping and event triggering. Configuring timers involves utilizing special function registers (SFRs) like TMOD, setting various modes of operation, and loading initial values into timer registers. Timers offer superior precision compared to loop-based software delays, ensuring reliability in time-sensitive applications.

The AT89C51's timer modes include 13-bit, 16-bit, and 8-bit Auto Reload, catering to diverse application needs. Programming timers can be achieved through polling, involving regular flag checks, or interrupts, streamlining responses when the timer flag is raised. A solid understanding of timer operation, including rollover events, flag management, and choosing appropriate modes, is fundamental for designing efficient embedded systems. Timers play a crucial role beyond time delays, contributing to waveform generation, setting communication baud rates, and coordinating intricate time-dependent processes.

* LED Indication Logic:

- Implemented logic for LED indicators to provide visual feedback on device states and timer activity.

- Enhance user awareness of the system's operations through LEDs.

1. **Solution**