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Bluetooth-Controlled Paper Shredder Using Arduino Uno and HC-05

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Abstract *- This project presents the design and implementation of a Bluetooth-controlled paper shredder using Arduino Uno and the HC-05 Bluetooth module. The shredder motor is controlled wirelessly through a smartphone using a Bluetooth Serial Monitor application. The Arduino Uno acts as the central controller, receiving commands from the Bluetooth module and switching the shredder motor via a relay driver. This approach reduces manual effort, increases convenience, and provides a low-cost solution for document destruction and security. Experimental results demonstrated reliable motor operation, stable wireless connectivity, and minimal response delay, making the system suitable for small-scale office and personal use.*

Key Words: Paper Shredder, Arduino Uno, HC-05 Bluetooth Module, Relay Driver, Wireless Control,

Document Security

1. INTRODUCTION

Document security is a major concern in both personal and professional environments. Paper shredding is one of the most effective ways to dispose of confidential information securely. Conventional shredders typically require manual operation through physical switches, which may limit convenience. With the increasing adoption of automation and wireless technology, the need arises for a more efficient and user-friendly solution.

This project introduces a smart paper shredder that integrates an Arduino Uno microcontroller with an HC-05 Bluetooth module. The system allows the shredder motor to be controlled wirelessly using a smartphone and a Bluetooth Serial Monitor application. This not only enhances ease of use but also demonstrates how simple embedded systems can be adapted to improve traditional machines.

1.1 Motivation and Objective

The motivation behind this project is to create a cost-effective and accessible shredder system that eliminates manual switching. The objective is to design a Bluetooth-based control system that is reliable, easy to implement, and suitable for practical applications in households and small offices.

1.2 Overview of Components

Arduino Uno: Serves as the central processing unit, interpreting Bluetooth signals and controlling the motor.

HC-05 Bluetooth Module: Enables wireless communication between the smartphone and Arduino.

Relay Driver Module: Acts as an interface between the low-voltage control circuit and the shredder motor.

Paper Shredder Motor: Executes the shredding operation when powered via relay switching.

Smartphone with Bluetooth Serial Monitor App: Provides the wireless interface for sending commands such as “ON” and “OFF.”

2. SYSTEM COMPONENTS AND CONNECTIONS

The shredder is controlled by the Arduino Uno, which receives wireless commands from the HC-05 Bluetooth module. The Arduino then activates or deactivates a relay driver circuit to switch the shredder motor.

Connections:

1.HC-05 Module: VCC to 5V, GND to GND, TX to RX (Arduino pin 0), RX to TX (Arduino pin 1, via voltage divider)

2.Relay Module: IN to Arduino digital pin, VCC to 5V, GND to GND

3.Shredder Motor: Connected to relay output terminals for power switching

This setup ensures safe and reliable operation of the shredder motor while maintaining wireless control.

Arduino Uno:

The Arduino Uno is an open-source microcontroller board based on the ATmega328P. It acts as the brain of the paper shredder system by processing incoming Bluetooth commands from the HC-05 module and controlling the motor through a relay driver. The Uno provides 14 digital input/output pins, 6 analog inputs, a USB connection for programming, and a 16 MHz quartz crystal for stable operation. It is widely used for embedded and automation projects due to its simplicity, cost-effectiveness, and

extensive community support. In this project, the Arduino Uno ensures real-time response to Bluetooth signals, making the shredder motor control both reliable and efficient.

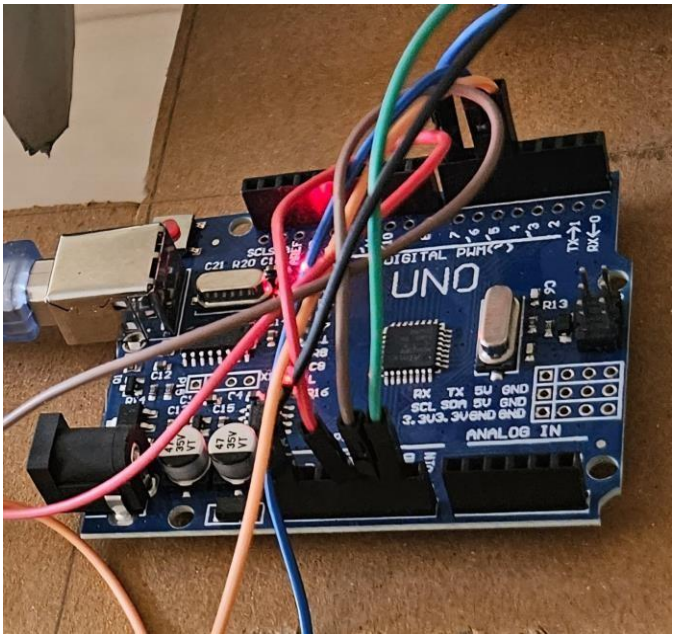

figure -1: Arduino Uno **HC-05 Bluetooth:**

The **HC-05** is a popular Bluetooth **Serial Port Protocol (SPP) module** used to enable wireless communication between devices like Arduino and smartphones. It can operate in **Master** or **Slave** mode, making it versatile for various applications. In our project, it was configured in **Slave mode** to allow the Arduino to receive commands from a mobile phone via a Bluetooth serial monitor app.

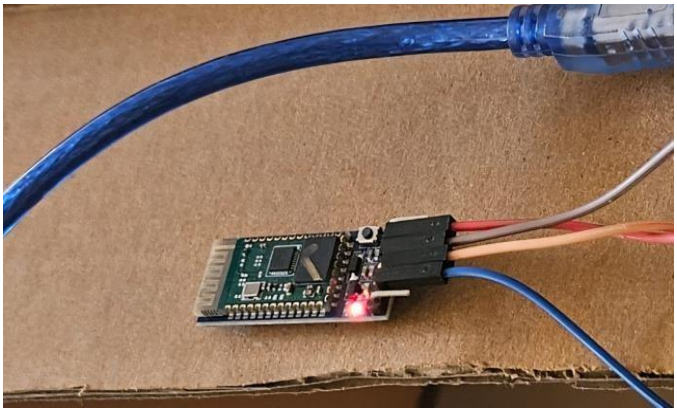

Fig -2: HC-05 Bluetooth

3. SOFTWARE IMPLEMENTATION:

The Arduino Uno was programmed using the Arduino IDE. The code continuously listens for Bluetooth input via the HC-05 module. When the command "ON" is received, the relay is activated, powering the shredder motor. When the command "OFF" is received, the relay is deactivated, and the motor stops. The smartphone connects to the HC-05 module using a Bluetooth Serial Monitor app. The user enters simple text commands, which are transmitted wirelessly to the Arduino. This direct communication method makes the system simple and effective without requiring a custom mobile application.

4. RESULTS AND ANALYSIS

The prototype was tested for performance and reliability. The Bluetooth connection remained stable within a radius of approximately 10 meters. Commands sent from the smartphone were executed instantly, with negligible delay in motor operation. The relay switching worked consistently, allowing smooth control of the shredder motor.

The system successfully demonstrated that conventional shredders can be upgraded with wireless control using minimal additional hardware. The simplicity of the design also makes it suitable for low-cost implementation in small-scale environments.

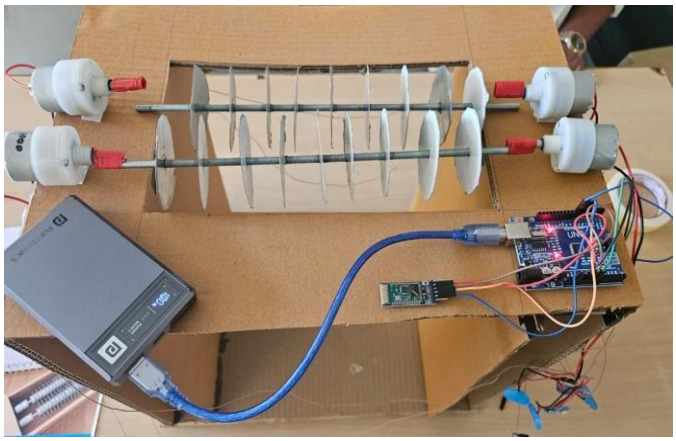

Fig -4: Result

5. CONCLUSION

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