FluxCharge Vision — Smart Wireless Power Transfer System

Contactless Charging with Sensing, Monitoring & Embedded Control

Developer: Shlok

Project Overview: The Future of Wireless Power

The FluxCharge Vision project introduces a sophisticated prototype for smart wireless power transfer. This system is engineered to provide safe, efficient, and contactless charging solutions, primarily targeting vehicle applications through automatic detection.

Purpose

To enable safe, contactless charging with **automatic vehicle detection** and embedded control.

Modularity

Designed as a **modular, IoT-ready hardware platform** for seamless integration and future expansion.

Core System Features

Our prototype integrates several key features to ensure intelligent and reliable wireless power delivery.

IR Detection

Infrared-based vehicle/object detection for precise activation.

Relay Control

Transmitter pad controlled by relays for safe power management.

Live Monitoring

Real-time current and power monitoring to ensure stability.

LCD Display

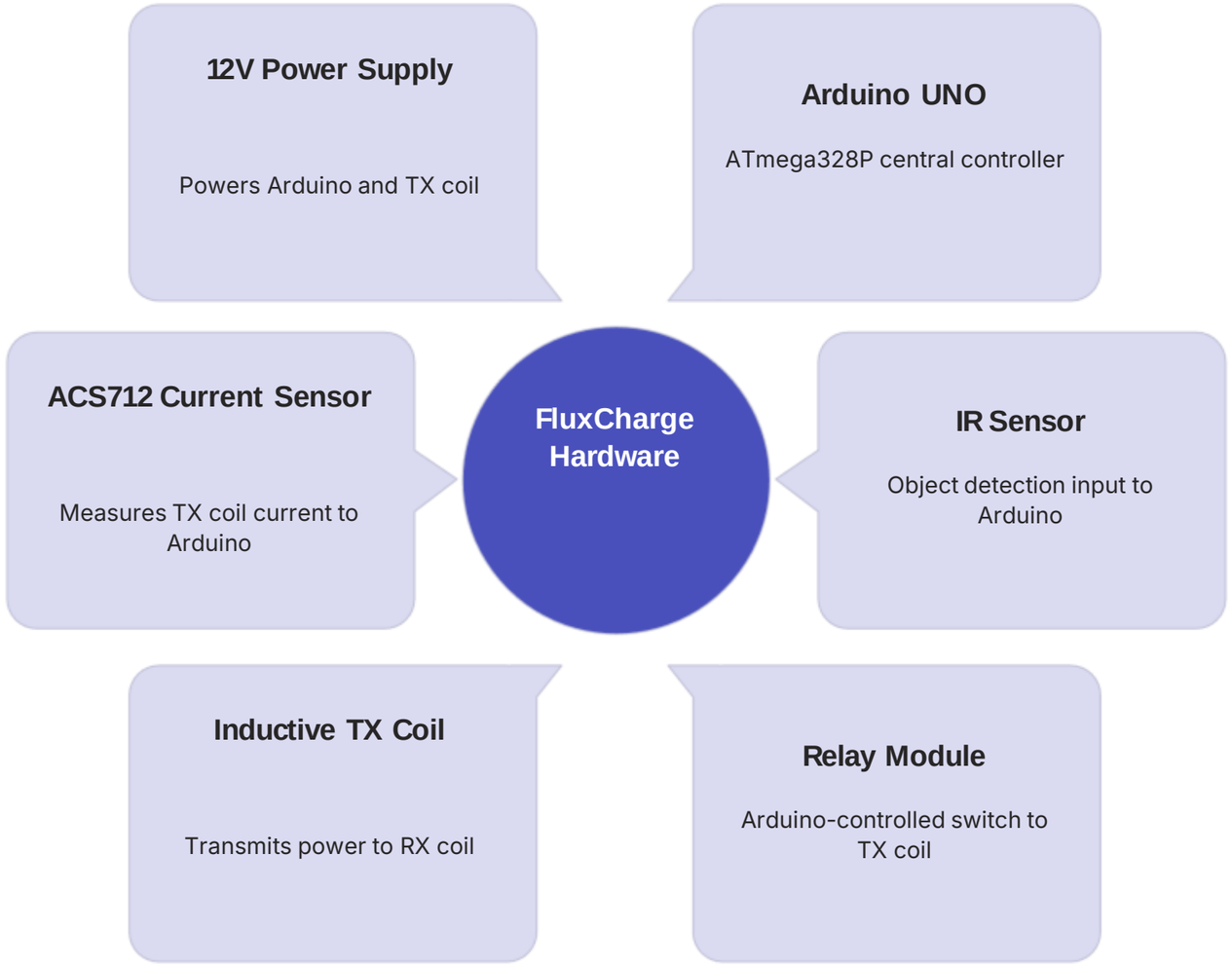
Integrated LCD for immediate status feedback to users.

Optimized Coils

Custom-designed inductive coils for efficient and stable power transfer.

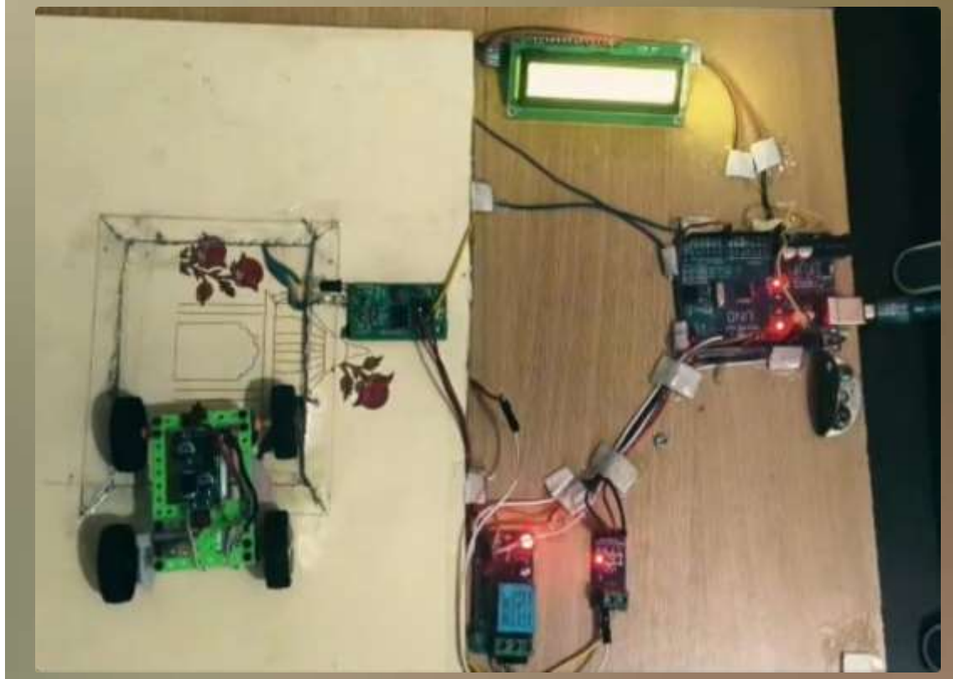
Hardware Architecture

The FluxCharge prototype is built upon a robust set of interconnected hardware components, forming a reliable foundation for smart wireless charging.



Key Components:

- ACS712 Current Sensor for monitoring
- 12V Supply, Regulation & Protection Circuitry



Detection & Automation Logic

The system employs intelligent logic to automate the wireless charging process, ensuring both convenience and safety.

IR Sensor Trigger

Detects presence of vehicle/object, sending a signal to the microcontroller.

Microcontroller Check

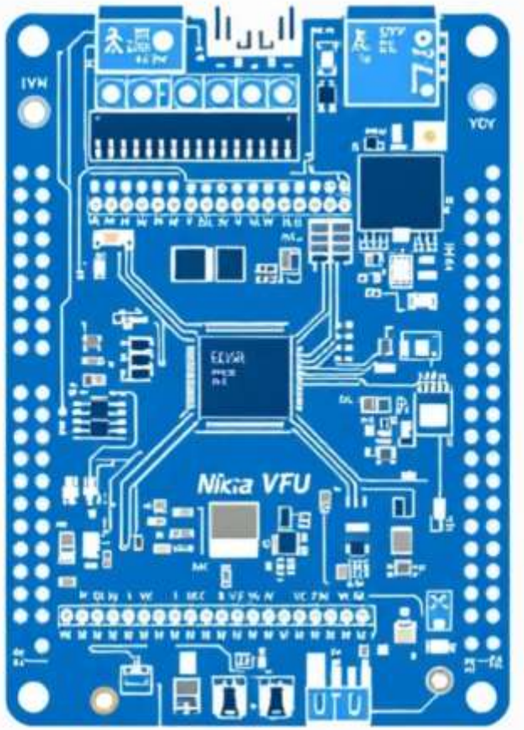
Processes the IR signal, verifying stable detection before proceeding.

Relay Activation

Activates the relay to turn the TX pad ON, initiating power transfer.

Safety Cutoff

Integrated debounce logic and safety cutoff mechanisms prevent false positives and overcurrent conditions (via ACS712).



Measurement & Monitoring

Continuous monitoring is crucial for optimizing performance and ensuring the safe operation of the wireless power system.

1

Current Sensing

The ACS712 sensor accurately measures current flowing through the TX coil.

2

Power Calculation

Sampled current data is used to calculate real-time power transfer metrics.

3

Real-time Display

All key metrics are displayed on an LCD for immediate feedback and diagnostics.

4

Stability Monitoring

System continuously monitors for stability and adapts to load changes.

Software Architecture

The embedded software, developed in Arduino C/C++, orchestrates the seamless interaction between hardware components.

- **Programming Language**

  Developed in **Arduino C/C++** for efficient microcontroller operation.

- **I/O Management**

  Utilizes **Digital I/O** for IR sensor and relay control.

- **Analog Reading**

  Analog inputs read data from the ACS712 current sensor.

- **Communication Protocols**

  I²C communication facilitates data transfer to the LCD display.

- **Embedded Logic**

  Implements critical **threshold logic and safety routines** for robust operation.

Power Electronics & Coil Design

Careful consideration of power electronics and inductive coil design is paramount for efficient and reliable wireless power transfer.

12V Input Stage

Robust power input stage ensures stable voltage supply to the system.

Relay Isolation

Relays provide crucial electrical isolation and control over the TX pad.

Coil Alignment

Design accounts for optimal coil alignment to maximize transfer efficiency.

Coupling Factors

Optimized inductive coupling factors to enhance power transmission.

Coil Geometry

Precise coil spacing and geometry reduce losses and improve performance.

Results & Output: A Functional Prototype

The FluxCharge prototype successfully demonstrates the core functionalities of a smart wireless power transfer system.

Reliable Detection

Automatic vehicle/object detection operates consistently and accurately.

Stable Power Transfer

Achieved consistent and stable wireless power delivery to the receiver.

Live Metrics

The LCD provides accurate, real-time current and power readings.

IoT-Ready

The modular design supports future IoT expansion, like ESP32 integration.

Conclusion & Future Enhancements

The FluxCharge Vision prototype serves as a solid foundation for advanced wireless power solutions.

Successful Demonstration

Validated a smart wireless charging system integrating sensing, power, and display features.

ESP32 IoT Dashboard

Integrate an ESP32 for cloud-based monitoring and remote control.

Enhanced Coils

Further optimize coil designs for even higher efficiency and range.

Auto-Parking Alignment

Develop automated alignment mechanisms for vehicles during parking.

Advanced Safety Interlocks

Implement more sophisticated safety features to protect users and devices.