Nurrohman, T. (2023). Prototipe Sederhana Pembayaran Menggunakan E-Money Card. ELINVO (Electronics, Informatics, and Vocational Education), *Desember 2023 edisi; vol(1), hal. 5. DOI: 10.21831/elinvo...*

"PROTOTIPE SEDERHANA PEMBAYARAN MENGGUNAKAN E-MONEY CARD"

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ABSTRACT

This study aims to design and implement a prototype of an e-money card payment system utilizing NodeMCU ESP8266 technology and RFID RC522 modules. The research methodology includes requirements analysis, hardware and software design, and prototype implementation. The result is a system that enables easy payments using e-money cards detected by an RFID reader and processed by NodeMCU. Transaction data is sent via WiFi to a MySQL database. A web interface is created for user registration, balance topping up, and transaction logs. The prototype runs well and promises enhancement for a more advanced electronic payment system in the future.

Keywords: *prototype, e-money, NodeMCU, RFID, electronic payment*

INTRODUCTION

In the ever-evolving digital era, the use of cash as a payment instrument is shifting towards electronic payment methods. This research is motivated by the fact that not all people have NFC features on their respective smartphones. This project was created taking into account this situation. In the modern era, E-Money (electronic money) systems have become a popular and efficient solution to facilitate cashless transactions, although most people already have E-Money. However, there are still a small number of people who still prefer to transact using physical cash.

The Internet of Things (IoT) project that focuses on developing E-Money systems using Radio-Frequency Identification (RFID) and NodeMCU V3 technology provides a positive contribution in advancing modern payment technology. The use of RFID technology which assists in security, logistics, and now electronic payments, enables quick and contactless identification and authentication, providing a more efficient and comfortable transaction experience. Meanwhile, NodeMCU V3 is an open-source development platform based on the ESP8266 ESP-12E module. This module provides various features such as Wi-Fi connectivity, GPIO (General Purpose Input Output), and support for the Lua programming language.

NodeMCU V3 can be used as part of a wireless connected solution to manage financial transactions and data. NodeMCU can be integrated with RFID sensors to read e-money cards, and then transfer transaction data via Wi-Fi connection to an e-money management server or platform. The combination of NodeMCU and RFID can be relevant in meeting society's demands for modern, fast, and secure payment methods.

PROJECT WORK METHODS

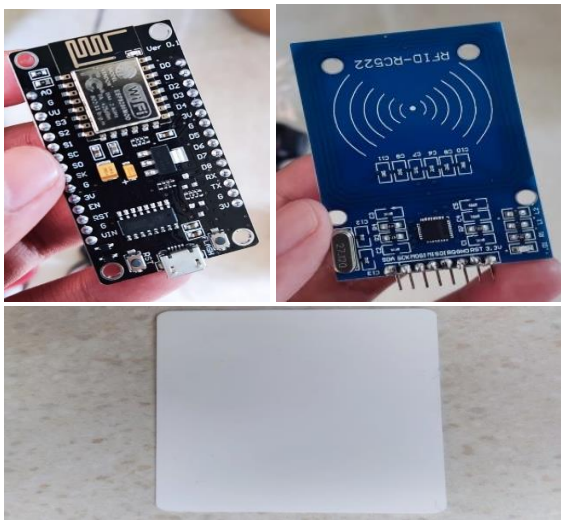
The prototype e-money payment system development methods consist of several stages:

1. Literature Study

A literature study was carried out to study relevant theoretical bases such as the development of electronic payments, NodeMCU ESP8266 technology, and RFID.

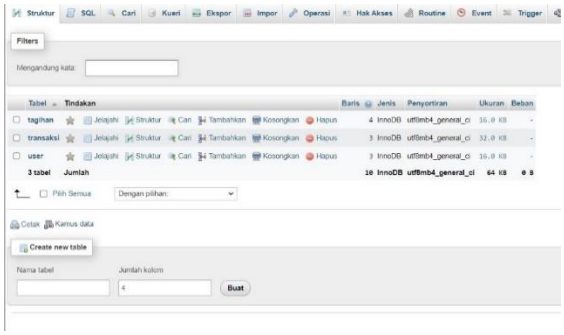
2. Preparation of tools and materials

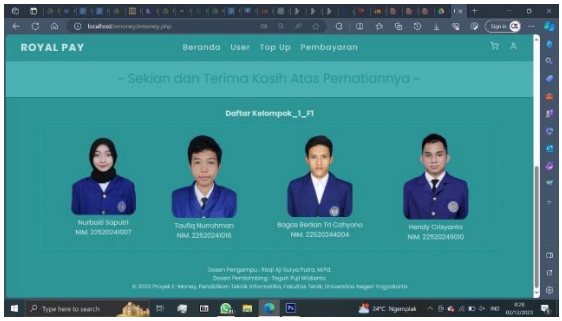
The tools and materials used include: NodeMCU ESP8266, RFID RC522 module, jumper cables, breadboard, RFID card, and software such as Arduino IDE and VSCode.

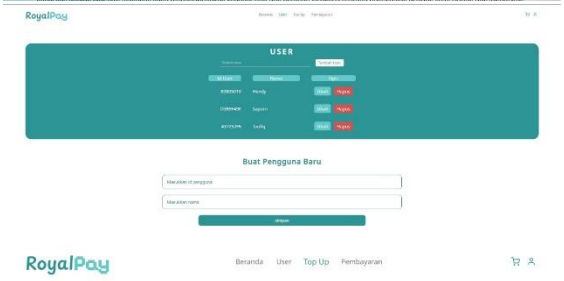


3. System Design

Complete prototype design was carried out starting from hardware to database. The database was created using MySQL and a web-based interface.

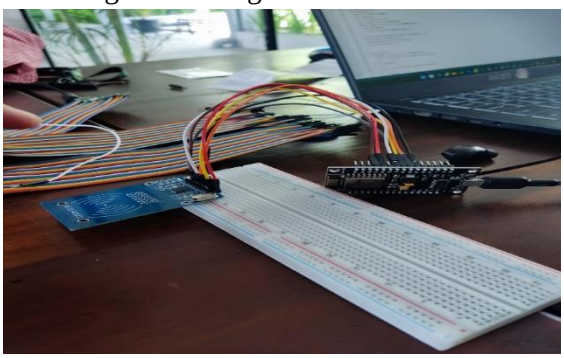


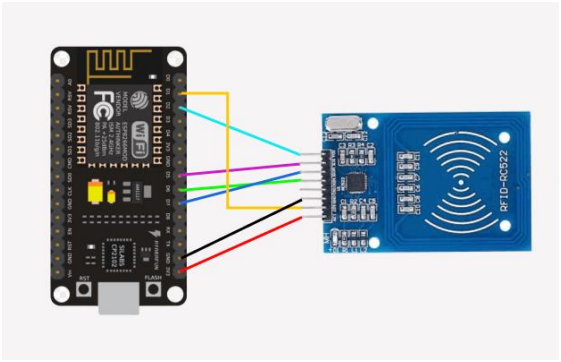




4. Hardware Configuration

The ESP8266 NodeMCU is connected to the RC522 RFID module using jumper cables according to the designed circuit scheme.





NodeMCU	RFID
D3	RST
D4	SDA
D5	SCK
D6	MISO
D7	MOSI
VCC	3.3V
GND	GND
IRQ	

5. Programming

The NodeMCU microcontroller was programmed using C language with Arduino IDE to integrate input from the RFID reader and send data via the WiFi network.

hello-world.js

```
#include <ArduinoWiFiServer.h>
#include <BearSSLHelpers.h>
#include <CertStoreBearSSL.h>
#include <ESP8266WiFi.h>
#include <ESP8266WiFiAP.h>
#include <ESP8266WiFiGeneric.h>
#include <ESP8266WiFiGratuitous.h>
#include <ESP8266WiFiMulti.h>
#include <ESP8266WiFiSTA.h>
#include <ESP8266WiFiScan.h>
#include <ESP8266WiFiType.h>
#include <WiFiClient.h>
#include <WiFiClientSecure.h>
#include <WiFiClientSecureBearSSL.h>
#include <WiFiServer.h>
#include <WiFiServerSecure.h>
#include <WiFiServerSecureBearSSL.h>
#include <WiFiUdp.h>

#include <SPI.h>
#include <MFRC522.h>
#include <ArduinoJson.h>
#include <ESP8266HTTPClient.h>

#define SS_PIN D4  //D4
#define RST_PIN D3 //D3

MFRC522 mfrc522(SS_PIN, RST_PIN);
const char* ssid = "Me_";
const char* password = "1133331ima";
String content;
void setup() {
  Serial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting..");
  }
  Serial.print("Use this URL to connect: ");
  Serial.print("http://");
  Serial.print(WiFi.localIP());
  Serial.println("");
}

void loop() {
  if (WiFi.status() == WL_CONNECTED) {
    if ( ! mfrc522.PICC_IsNewCardPresent())
    {
      return;
    }
    if ( ! mfrc522.PICC_ReadCardSerial())
    {
      return;
    }
    Serial.println();
    Serial.print(" UID tag :");
    content = "";
    byte letter;

    for (byte i = 0; i < mfrc522.uid.size; i++)
    {
      Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? "0" : "");
      Serial.print(mfrc522.uid.uidByte[i], HEX);
      content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? "0" : ""));
      content.concat(String(mfrc522.uid.uidByte[i], HEX));
    }
    content.toUpperCase();
    Serial.println();
    delay(1000);
    parseJson();
  } else {
    Serial.println("Error in WiFi connection");
  }
}

void parseJson() {
  if (WiFi.status() == WL_CONNECTED) {
    WiFiClient client;  // Create a WiFi client instance

    // Menggunakan metode GET dengan menyematkan parameter uid ke URL
    String url = "http://192.168.57.105/project/E_MoneyCard/proses.php?uid=" + content;

    HTTPClient http;
    http.begin(client, url); // Gunakan URL dengan parameter uid
    int httpResponseCode = http.GET();
    delay(100);
    delay(100);
    if (httpResponseCode > 0) {
      String response = http.getString();
      Serial.println("Received HTTP Response:");
      Serial.println(response);
      char json[500];
      response.toCharArray(json, 500);
      StaticJsonDocument<200> doc;
      DeserializationError error = deserializeJson(doc, json);

      if (error) {
        Serial.print("deserializeJson() failed: ");
        Serial.println(error.c_str());
      } else {
        // Cetak informasi yang diambil dari JSON

        const char* status = doc["Detail"]["Status"];
        const char* id = doc["Detail"]["Data User"]["id_user"];
        const char* nama = doc["Detail"]["Data User"]["nama"];
        int saldo_sebelum = doc["Detail"]["Data User"]["saldo"];
        int nilai_transaksi = doc["Detail"]["Nilai Transaksi"];
        int saldo_sekarang = doc["Detail"]["Saldo Akhir"];

        Serial.println("=============== HASIL PARSING RESPONSE ==========");
        Serial.print("status transaksi = ");
        Serial.println(status);
        Serial.print("Nama Pengguna = ");
        Serial.println(nama);
        Serial.print("ID = ");
        Serial.println(id);
        Serial.print("Saldo sebelum = ");
        Serial.println(saldo_sebelum);
        Serial.print("Tagihan = ");
        Serial.println(nilai_transaksi);
        Serial.print("Saldo Sekarang = ");
        Serial.println(saldo_sekarang);

 Serial.println("================================================");
      }

    } else {
      Serial.print("Error on sending POST. Response code: ");
      Serial.println(httpResponseCode);
      Serial.println(http.errorToString(httpResponseCode).c_str());
    }
    delay(2000);
    http.end();
  } else {
    Serial.println("Error: Not connected to WiFi");
  }
}
```

6. Testing and Evaluation

Testing is carried out by making payment transactions using a test card and ensuring the prototype runs well.

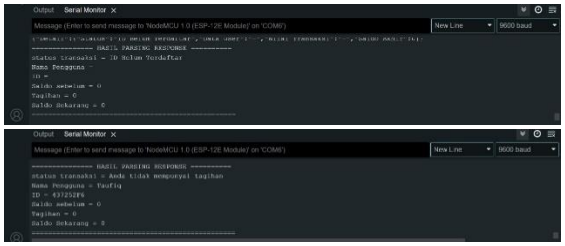
a. Prepare an E-Money Card

b. Scan Card using RFID RC522

c. If the User ID has not been registered, please register the user ID first using the website

d. Enter the balance first

e. You can now make payments/transactions using: scan E-Money Card on RFID RC255



Topup saldo :

Pembayaran :

7. System Improvements

Make repairs and improvements to the system if errors or bugs are found during testing.

RESULT AND DISCUSSION

1. System Design

The E-Money payment system is designed to consist of several main components:

- NodeMCU ESP8266 as a microcontroller, - RFID RC522 module to read E-Money card data,

- MySQL database to record balance and transaction data,

- Web interface for user registration, balance top up, and transaction log,

- E-Money database on the server as a backend system

2. Prototype Implementation

The E-Money payment system prototype was implemented with the following steps:

- NodeMCU is connected to the RC522 RFID module

- Created database and web interface on the server using MySQL and PHP

- NodeMCU programming using Arduino IDE

- Data integration from RFID to database via WiFi network

- Testing payment and transaction flows using test cards

3. Testing and Evaluation

- System functionality testing:

Reading e-money cards by RFID reader, Transferring and updating balance data to the server, Transaction logs in the database

- Security and authentication testing

- Average transaction speed testing <1 second

- Testing of simultaneous data processing by several users

The evaluation results show that the prototype functions well according to requirement specifications. The prototype is able to handle E-Money transactions easily, quickly and safely. Thus, this system is promising as a future electronic payment model.

CONCLUSION

This simple prototype of payment using an e-money card provides convenience and efficiency of cashless transactions. The use of NodeMCU ESP8266 and RFID technology is able to realize a modern payment system that is practical, fast, safe and comfortable.

The main advantages of this prototype are ease of use without complicated verification, acceleration of the transaction process, and reduced risk of losing physical money. By implementing this system, it is hoped that it can reduce the use of cash and encourage an increase in non-cash transactions.

In future development, this E-Money

payment system prototype can be refined into a smart card-based E-Money product that can be used at various merchants. Integrating biometric technology can also improve user authentication security. With continuous innovation, it is hoped that this prototype can develop into a reliable and trustworthy future electronic payment solution.

TEAM MOTIVATION

When you feel Tired, don't forget to eat and surrender yourself to God.

DOKUMENTASI

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MY CONTRIBUTION

So in this team we divide the tasks for each team and my tasks in this project are Home Web Maker and Journaling.