

# Ekenedirichukwu N. Obianom

**Field:** Electronics Engineering

**Expertise:** Embedded C, Arduino, Control Systems, Python, Circuit Design, PCB Layout, Machine Learning

## **Embedded Systems Portfolio (Total: 12)**

### **1. DIY Telephone**

A design was proposed for a rechargeable telephone. It was to be designed with cheap DIY (Do-It-Yourself) components. The construct was completed with the use of an Arduino pro-mini for data processing and a sim800l module GSM connectivity. The telephone consisted of a screen, a 4x4 keypad, a speaker, a microphone and an extension to include external sounds during calls (like music), a ring volume control, and a charging port.

### **2. Autonomous Shopping Cart**

In grocery stores, mechanisms that would improve sales and ease customer stress are constantly being searched for. This design focused on the automating the shopping cart. The shopping carts were improved to be self-driving. The system was designed to be easily integrated into any shopping mall without need to redesign the malls. It used ultrasonic sensors to map its environment and track its user while using an array of relays to control the movement of the rotation of the motors.

### **3. NITDA Hackathon (2022): Smart Farming**

My team (Yieldas) came second place out of ten in the 2022 South-South version of the NITDA Hackathon competition in University of Calabar, Calabar, Cross River, Nigeria. Our proposed idea was the use of weather forecast, NPK sensors, temperature sensors, humidity sensors, pH sensors, in conjunction with an artificial intelligence (AI) system to proffer best farm practices for local farmers at a cheap rate and all year round. With such technology, the yearly yield is predicted to increase. It is also estimated that the business plan team Yieldas designed around this project is estimated to regain its capital in just over a year or running the business.

### **4. Design and Construction of a Remote-Controlled Ceiling Fan Regulator**

A ceiling fan regulator is a device used to control the speed of a ceiling fan. It operates controlling the voltage across the fan (Deki Electronics Ltd, 2012). There are different

types of regulators based on the method used for regulation. The most common types are resistive regulators, phase angle-controlled regulators, inductive regulators and capacitive regulators. They each have their advantages and disadvantages. This project uses a capacitive regulator due to its advantages on cost, linear control, energy efficiency, reliability, soundlessness and light weight. For transmission and reception of control messages between remote and regulator infrared (IR) light is harnessed with the use of IR LED and IR receivers. Specifically, this project is focused on how a remote can be used to send unique codes to a receiver unit which then processes it and performs regulatory actions based on it.

#### **5. Shoe Based Piezoelectric Generator**

Piezoelectric generators harness the piezoelectric effect to produce electrical power. The piezoelectric effect is the ability of certain materials to generate electric charge in response to mechanical stress. The shoe based piezoelectric generator harnesses the mechanical stress that occurs while walking or jogging or running to produce electricity. This project focuses on the base of the feet which ultimately carries the weight of the human body. A group of piezoelectric materials are arranged such that walking, standing or even stretching can be harnessed from beneath the feet to produce electricity. This project is also focused on using this harnessed energy to charge a mobile phone.

#### **6. Vein Dilation System for Clogged Veins in Sickle Cell Anaemia Patients**

Clogged veins are a common phenomenon that occurs to sickle cell anaemia patients. It is popularly known as the sickle cell crisis (Larissa Hirsch, 2018). This occurs due to the unusual nature of the red blood cells of sickle cell anaemia patients. Unlike the regular disk shape, their red blood cells are stiff, sticky and sickle shaped. The crisis is caused by the clogging of the arteries and veins by the unusually shaped red blood cells. The symptoms are characterized by swelling, redness, skin warm to touch, cramping of muscles, increased pulse rate and pain that could last from hours to days (Mercy Medical Center). This project condenses warm compresses and massages. It inculcates a sensor system to measure body temperature and pulse rate in comparison to a specified threshold given by the patient's physician. If this threshold is passed, it begins to massage and warm that area of the body to allow for veins to dilate thereby unclogging the vein. This is a localized solution.

#### **7. Substitution Board Redesign**

The substitution board is a display unit used to relate information to football players and spectators at large. The usual design is made up of four seven-segment displays. The two digits by the left display red colour to show the outgoing player, while the two digits by the right display green colour to show the incoming player (Innocent). It is also useful in showing the extra time given towards the end of the game. In this project we will focus on redesigning the substitution board with only two seven segment displays. It will display red colour at first to show the outgoing player, then it will show green to show the incoming player.

#### **8. The Use of Radio Frequency Identification (RFID) to Control the Door Lock**

RFID is an innovative system that allows for identification via contactless technology. It operates by radio communication (AB&R). The RFID reader constantly outputs a power signal and reads for incoming signals. When an RFID chip comes near the reader it harvests the energy from the power signal (NXP). This harvested energy is just enough for the chip to send out a signal indicating its unique number. The reader gets this unique number and sends it to the microcontroller for processing. Specifically, this project is focused on how the microcontroller uses the unique numbers sent to it from the RFID reader to alter its memory and open a door lock.

#### **9. Gas Sensor (MQ5) Controlled Solenoid Valve**

Gas leakage is a dangerous phenomenon and can cause great damage to property (Jayne et Elaine, 2018). It could cause explosions most especially. This project is focused on the construction of a gas sensing system that senses the gases both inside and outside the building. It would also be capable of raising alarm and shutting off a valve whenever critical gas levels are reached. MQ5 gas sensors are the sensors used in the project. MQ5 operates by sending a varying voltage based on the varying gas sensed in the surrounding (Seed, 2020).

#### **10. Forward Vehicle Collision Prevention System**

Lidar sensors were used to detect the forward distance to the closest object. Infrared speed sensor was used to measure the speed of the moving vehicle. The breaking distance of the moving vehicle was computed by an Arduino then compared to the forward distance of the moving object. If the breaking distance is smaller, it means an accident could occur and a caution is sent to the user.

#### **11. Prototyping of a Rotor Resistance Starter of a Wound Rotor Induction Motor Using Control Timer**

This method adopts the use of microcontroller ATmega328P to create a controller that partially removes the need for human intervention. It was used for timing and controlling this new method. A circuitry was built around this integrated circuit. Based on the time set, the microcontroller operates a motor to rotate a particular angle within the time frame. This motor is mechanically coupled to rheostats to vary the current. So, the rotation of the motor rotates the rheostat to control vary the current in the rotor circuit. Tests carried out include test for transient, timing test and reliability and durability test. The results show that the starting time is accurate and removes human interference during starting. The average deviation of the result from the pre-set time is considerably low; hence precision is hence precision is high. The reliability and durability of its performance is also high. The result also shows lack of transients during the starting and high accuracy of timing.

## **12. Airbus Project (2016 – 2017): Automated Taxiing Technology in Airports**

My team (Team Nevada) were part of the five (5) finalists of the 2017 Fly Your Ideas competition in the world which we presented at the Airbus Headquarters, France. Our proposed idea was the use of an automated taxiing system to improve the airport traffic. The system was to adopt the present 4d technology (that combines length, width, height and time) in combination with a smart computer that would route each flight into the schedule based on each of their 4d information. The 4d information was to control the flights from landing to take off. This will reduce the amount of time spent on taxiing and increase the amount of flight taxiing at the same time.