**DESIGN AND IMPLEMENTATION OF DATABASE COMMUNICATION INTERFACE BETWEEN EMBEDDED SYSTEMS AND COMPUTER SYSTEMS**

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CHAPTER ONE

**INTRODUCTION**

* 1. **BACKGROUND OF STUDY**

Digital systems can be classified into two categories: general-purpose systems and application-specific systems. General-purpose systems can be programmed to run a variety of applications, i.e., they are not designed for any special application and can perform most common computing task, an example is a Desktop/laptop system this is a system capable of performing various tasks and is customizable in software, it can perform lots of task with little or no constraints on power, performance or cost also the are contained in themselves and no part of a larger system, as opposed to application-specific systems. Application-specific systems can be part of a larger host system and perform specific functions within the host system, and such systems are usually referred to as embedded systems. An embedded system is implemented partly on software and partly on hardware. When standard microprocessors, microcontrollers or DSP processors are used, specialization of an embedded system for a particular application consists primarily on the specialization of software,

The synergy created from the combination of this two systems can be called the next step in digital systems, being able to make them communicate and share data would push the boundary of science one step further, P. J. Plauger (1989) has argued that what makes embedded and real-time systems development special is a preoccupation with time. timing, speed, sequencing, and synchronization.

This project looks at the connection of these two digital systems, the embedded system which is required to perform a specific task (measure height or weight and control student access within the school environment) to the desktop/laptop system which holds the database that guides the decision of the embedded system through an “interface”.

Speaking on the focus for this project which involves the designing of an “interface” ,this offers the services of a bridge/link between our embedded system and host computer it could come as a wired or wireless, for instance connection between your mobile phone an your PC ,your mobile device is an embedded system and your USB cord is an interface.

**1.1.1 INTERFACE**

Computers or other device connected to a computer network are called **network gateway** (which is communication with communication module of embedded device presented) ,they may offer information ,resources ,services, and applications to users or embedded systems on the same nodes ,commuters that participate in networks and use internet protocols can be called IP hosts , Specifically, computers participating in the Internet are called Internet hosts, sometimes Internet nodes.

Network hosts that participate in applications that use the client-server model of computing are classified as server or client systems. Network hosts may also function as nodes in peer-to-peer applications, in which all nodes share and consume resources in an equipotent manner. The network host serves as the control center of the embedded system. It can be used to:

• control the data acquisition unit (DAQ), in this case the embedded system.

• provide a graphical user interface (GUI) for the user to operate the system (with use of web GUI based on http protocol)

• store the acquired information on mass storage devices

• provide the tools to display and/or analyze the acquired data in real or non-real time

As in this case where we interface an embedded system to a PC to improve storage capability , utilize tools provided on a web GUI to analyze and exchange data.

**1.1.2 DATABASE**

These are basically containers for the data, they are computer structures that save, organize, update, manage, protect, and deliver data and a system that contains databases is a database management system DBM, the relational database is the most utilized kind of database, where digital data/information is stored in rows, columns, and tables which are indexed to ease search for relevant information through SQL queries.

Databases have played significant parts in recent evolution of computers, computer programs produced in the 1950s were used mostly for calculators and data like names, phone, numbers were counted as leftovers so focus was placed on languages and algorithms until they became commercial entities and business people utilized them, then the leftovers became Important to them creating the need for an ordered means of storage, granting a significant number of individual or connected devices capability to capture, store and analyze data for the purpose of making decisions like the embedded system needs the pc database. On each device, information is collected and filtered before it is shared with other systems. Ultimately, the information originating from these devices will be essential to gain insight and inform the decisions of the embedded system.

In the pursuit for better and evolved gadgets, improvements need to be made towards realizing this devices, which arises the need for a means to interact with large amount of data that a user has to filter through or manage e.g. database of embedded systems used for access control must keep track of every entrance and exit from every access point. With the increase in information to be managed by embedded systems, it becomes important to store and manage data more efficiently and in a uniform manner, Current Methods used for storing and manipulating data objects in embedded and real-time systems are ad hoc, in this system data objects are manipulated as internal data structures. That is, data management of an embedded system is built as part of the overall system, this is not cost-effective with respect to design, implementation and verification e.g. it would be far expensive to place a full database system or interface panel in a school organization with over 20 entry points, in addition, this technique would make it quite difficult to link the devices to other embedded systems or larger database with central access.

Connecting an embedded system to a computer gives it the positive edge of the above-mentioned set of focus granting the system power to provide support for storage and manipulation of data and gives users some significant edges:

(i) reduction of development costs due to the reuse of database systems;

(ii) improvement of quality in the design of embedded systems since the database provides support for consistent and safe manipulation of data and at the same time reducing data footprint in the embedded system memory,

(iii) increased ease of operation as operations come down to the click of a button, the slide of an icon or simple character input, consequently, this improves the overall user-friendliness and utilization of the system in any field. making it possible to tailor it to any profession or place of utilization.

This project presents the utilization of a database communication interface to govern the manipulation of data in the embedded systems of a BMI (Body Mass Index) and Access control system using a valid RFID chip as a means of identification and record insertion, thereby overcoming most of the shortcomings of a compact embedded system.

**1.1.3 EMBEDDED SYSTEM**

Embedded systems as stated earlier are systems designed for a specific purpose, they combination of hardware, software and mechanical components, many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. Some applications of embedded system are in the automotive ﬁled as control system or A washing machine, from an embedded systems point of view has:

a. Hardware: Buttons, Display & buzzer, electronic circuitry.

b. Software: It has a chip on the circuit that holds the software which drives controls & monitors the various operations possible.

c. Mechanical Components: the internals of a washing machine which actually wash the clothes control the input and output of water, the chassis itself.

They are mainly utilized for:

1. Data Collection/Storage/Representation
2. Data communication
3. Data signal processing
4. Monitoring
5. Control

With each new day new ways of implementing them in our daily lives are being discovered and researched.

**1.2 STATEMENT OF PROBLEM**

Machine and computers are utilized in almost all walks of life and not all personnel are tech-savvy, not everybody knows how to strip a system down to its embedded systems or work with a complicated interface and make corrections or improve on its contents.

Based on this it is necessary to formulate a problem to be solved or resolved in the digital design. This paper and project concern itself on creating a system which gives users an easy way to interact with the hardware of the system/embedded system no matter their professions, also to proffer solutions to the rigidity of an embedded system, rigidity includes the following

1. Inability to improve or upgrade on its hard-wired data.

2. Difficulty to take a backup of embedded files

3. In the event of a fault, troubleshooting is quite difficult.

4. They have limited hardware options.

**1.3 AIM OF THE PROJECT**

Design and implement a means of communication through an interface between embedded systems and computer systems

**1.4 OBJECTIVE OF THE PROJECT**

The objective of this project is to:

I. Design a user interface that makes it easier to effect changes in the embedded system via a USB from our computer system.

II. Create a database whereby information about an RFID user is inserted, updated, deleted or backed up.

iii. In-corporate RFID card reading capabilities to the hardware.

**1.5 SCOPE AND LIMITATION**

This project focus on the implementation of a system that eases data manipulation by connecting the hardware system to a computer system database which can be edited or updated without the need for hardware disassembling through a user interface. The principle system can control the movement of an Access programmable cantilever control system and also collect or update user records from a BMI system both using an RFID chip. Thus, the serial communication interfaces on the personal computer (PC) as a liaison between both microcontrollers in the embedded system and database (MySQL) on my computer.

We could have also made use of a wireless system (The Arduino Ethernet Shield with some other materials connects your Arduino to the internet), made use of other forms of embedded system applications or different and better means for database manipulation but due to resource constraints and Time. We have decided to limit ourselves to the use of a serial port USB system to connect the embedded system to the PC, using embedded systems in Access controls and BMI equipment, also utilizing Xampp Apache servers for database collection and storage.

1.5 PROJECT ORGANIZATION

This project work will be contained in five (5) chapters.

Chapter one carries the introduction, problem statement, aim, and objective, the scope of the study, limitation of the work and the project report organization. Chapter two carries the literature review of the work along with other reviews of the project and the proposed method used to achieve the system. Chapter three carries the project design methodology and steps which lead to the construction of the project, the schematic representation of the system and diagram used, the program code to run the system. Chapter four involved testing the project design, observation and Bill of the project. This chapter covers the description of the project, the step by step details of the setup of the system, the result, the structure chart of the system, and the database model of the system. Chapter five is the conclusion and recommendation of the project.