A Research Study Presented to the Faculty of

CABANATUAN CITY SENIOR HIGH SCHOOL

Sta. Arcadia, Cabanatuan City

In Partial Fulfillment of the Requirements

for the Subject Capstone

EasyWiz: Utilization and Implementation of RFID Technology in Student Lockers and Machine Learning Models for Face Recognition-based Attendance System in Cabanatuan City Senior High School

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RATIONALE

Regardless of the significance of human life as both argued as important and non-significant by anthropic principle (Weinberg, 1989; Barrow & Tipler, 1988; Schrodinger, 1944) and the laws of nature (Kaku, 1995), respectively. Providing the rights, especially security and privacy is arguably an utmost necessity. However, due to the inefficiency and high vulnerability of currently implemented system mechanisms and the technology itself, it is easily voided. Furthermore, the exponential increase of technological advancements (Kaku, 1995) and the revolution it provides in understanding of the grand design (Katori *et al*., 2022) the progression of existing threats metamorphosed in the realms of technology, such as telemetry and spywares. Hence efforts are made to yield products that would prevent and decrease the progression of threat.

One of the yields by continuous efforts against security and privacy violation and exploitation in technological level is the movement to lean towards free and open source software (FOSS), while increased and improved locking mechanism has been the direction of combat against physical threats, and combination of both has also been proven to be efficient. Nevertheless, both measures have its own advantages and disadvantages, such as FOSS softwares requires the necessity of accessible codebase and algorithm, and physical measures on the other hand ascertain the decreased vulnerability of the mechanism through intensive maintenance.

Due to the accelerating improvement of technologies, it is necessary to keep up with the changes. Since stabilization is not sufficient, implementation is necessary as everyone is affected by changes in macro level due to the interconnectivity (Lewin *et al*., 2018; Lewin *et al*., 2022), a successful implementation of technological advancements would yield a benefit

to the particular society. Thus, the goal of the study is to implement the current technological advancement in Cabanatuan City Senior High School.

STATEMENT OF THE PROBLEM

The study aims to introduce a new system that replaces traditional methods, specifically the attendance checking and accessing container, such as storage room or student lockers via the utilization of RFID-based systems and microcomputers and microcontrollers, particularly arduino and raspberry pi, and determine whether it is more convenient than the traditional way. Hence, in the final analysis the study sought to :

1. Determine if the RFID Identification Card can be used in :

    a.) accessing lockers ;

    b.) and checking attendance.

2. Make a regression model of the cost-effectiveness of RFID-based systems against traditional methods in the time frame of :

    a.) 15 months ;

    b.) 24 months ;

    c.) 60 months.

3. Determine whether the RFID Technology system can replace the traditional checking of attendance and mechanical lock in terms of :

    a.) Convenience ;

    b.) Efficiency ;

    c.) security ;

    d.) and privacy.

OBJECTIVES

It is critical to guarantee the safety and security of students in school. Due to the exponential improvement of technology (Kaku, 1995), adapting to the changes is a necessity; thus, this study aims to provide information on implementation of the technological advancements to deal with and resist the infringement on security and privacy as well as its exploitation. Therefore, the aims of the study are :

a. Implement the current technological advancement for use in long term.
b. To develop *de novo* convenient and efficient system as a replacement of traditional attendance and locker access.
c. Utilize RFID card and machine learning for use in locker and attendance, and facial recognition software, respectively.

THEORETICAL FRAMEWORK

According to Letvina *et al.* (2021) machine learning, also known as computational learning theory, is the ability of a program to improve itself through repeated iteration on previous and new datasets. Avrim Brum, from Carnegie Mellon University, further defined it as an ability of the algorithm to improve itself and learn from new inputs and adapt to changes, which improves the performance through "*experience*". By doing so, machine learning algorithms can predict and simulate phenomena based on the previous dataset or random inputs from curated dataset, moreover, depending on the model type, it is also possible to produce *de novo* outputs from the algorithm (Letvina *et al*., 2021).

Regression algorithms, study the hypothesis(es), $\boldsymbol{h_0}$, based on parameters, θ_n, β_m, and values of the independent variable, $\boldsymbol{x_i}$, given on previous dataset, to predict the value of the

dependent variable y_i. The study modeled the cost efficiency of the RFID based systems over specific timeframes via utilization of simple linear regression algorithm, also known as ordinary least squares regression.

CONCEPTUAL FRAMEWORK

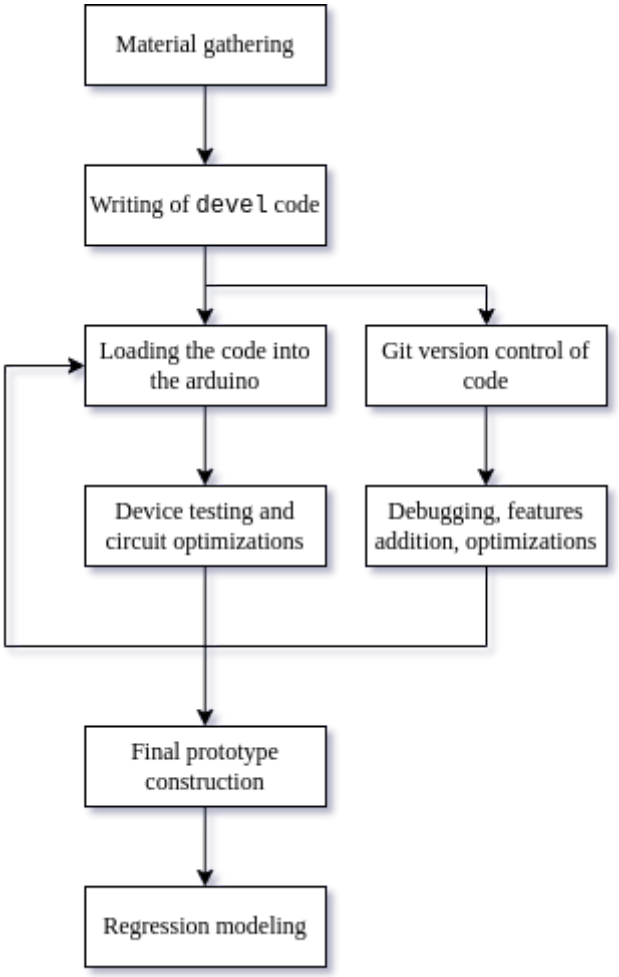

Figure 1: Conceptual Framework of the Study.

Figure 1 presents a brief description of the methodology of the study. The series is broken into 3 phases, the first phase is the preparation, this includes the gathering of the materials needed in the study, and the writing of the *pseudo*-code and its theoretical

implementation. The second phase is the pre-trial, this includes the forking of the main branch of the git version control repository of the main code, and loading of the first version of the main code into the system for testing. The git fork of the code was then further optimized and developed for implementation of new features that will be loaded in the system for next testing. The process was done repeatedly until there were no noticeable bugs to the end user perspective, considerable execution speed, and smooth execution of the program. Finally, the researchers removed the possible conflicts per code branch, and then branches of the code were merged with the main branch.

In the final phase, where the reported and caught bugs, errors and logical error, the final prototype was constructed, and a regression model was devised to show the cost efficiency of the models against traditional methods.

SIGNIFICANCE OF THE STUDY

The interconnectivity of every organism (Lewin *et al*., 2018; Lewin *et al*., 2022) relays the changes and actions of one to another, thus a change in one society will affect another and may affect even larger systems, which is also known as butterfly effect. Hence, making the correct action would probably lead to improvement of the particular society at the very least, while making the opposite will lead to acceleration of depressing consequence or the "*unyielding despair*", once echoed by mathematician and philosopher, Bertrand Russell (Kaku, 1995). The main goal of the study is to address the gap and vulnerability of currently implemented mechanisms and technology of traditional methods in Cabanatuan City Senior High School through utilization and implementation of microcomputers, microcontrollers and RFID technology as replacement of the traditional and inefficient methods currently in use.

School Administrators. This study can help the school administrators in determining the most cost-effective way by introducing this new system while also increasing the convenience for school administrators.

Students. This study can assist students in ensuring their safety and privacy within the school grounds. Using arduino and RFID technology for the school can increase student security and make students feel comfortable and safe inside the school area.

DEFINITION OF TERMS

Branch – is derivative of code base.

Container/Docker/Toolbox – is an isolated *pseudo* operating system (OS) used for virtualization, testing, and debugging of software, as well as simulation.

Container – is any physical storage or space, such as a locker or storage room.

Devel – is a programming technology for development, usually used as a name and package suffix of a branch of main code repositories and binaries, respectively.

Fork/Forking – is a function of the git version control system that replicates the repository of the desired code base

Merge – is the combining of two different branches or forks.

Modules – are external code library files, with a suffix of typically .py, that contains a specific set of functions.

Notebook – is a hosted Jupyter kernel and Linux kernel provided by Google Brain Team of Google Inc., with a sole purpose for use in data science, machine learning, deep learning and artificial intelligence, which can be also used in computational methods such as simulation and astrophysical data analysis.

Push – sending the changes from one repository, either local or other `git` repository, to the specific branch.

Pull – process of fetching the updates from the `git` repository into another repository.

Regression – is an algorithm (computer science) and set of equations (mathematics and statistics) used to predict y_i (dependent variable) using x_i with β and θ based on previous dataset.

`./` – parent directory.

`../` – previous directory.

`CWD` – current working directory.

`$HOME` – main directory of the user under either `/var` or `/` (root).

`$PATH` – directory where the system would search for executables.