

Automation of Vehicle Entry and Exit at Davao Oriental State College of Science and Technology

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Abstract

The main objective of the study was to develop an automated vehicle entry and exit program in the main gate of Davao Oriental State College of Science and Technology. It can automate the existing vehicle entrance and exits operation with the use of a micro computer, sensors, and a stand-alone program. It follows the Waterfall Model methodology of software engineering. The study provided a distinctive identity in classifying the authorized and non-authorized vehicles. It also has a visual application that displays the timed entry and exit of the school's faculty, staff, and currently enrolled students. The program also computes the total number of hours spent by the faculty and staff inside the campus, which is an aid for monitoring their time of duty in the college. The system can also provide an interactive button for manual opening and closing of the gate for those non-authorized vehicles. The study can provide the college an alternative system that is sophisticated in controlling and managing the entry and exit of vehicle in the campus. The college can have a reliable automated system that will work for 24 hours a day.

Keywords: Automation, entry, microcomputer, sensors, Vehicle

Introduction

Technology nowadays creates a big development in the country. Such as the real time applications, which are becoming increasingly important in our daily lives and can be found in various environments. Examples of real time applications include process control, factory automation robotics, vehicle simulation, image processing, and music or voice synthesis [NILS, 2000]. One of its examples is an automatic gate, which is highly needed in businesses, big companies and even in schools. This study proposes a real time application that will improve the existing school entry and exit of vehicle transaction through automation

procedure. It will automate the vehicle entrance and exit operation with the use of a microcomputer, sensors, and a stand-alone program. The study will make use of two vertical-lift gates with installed sensors on each gate, one gate for the entrance and the other is exit by the use of a Light Dependent Resistor (LDR) sensor, the system identifies whether the vehicle is authorized or not to be able to enter the campus. If the vehicle is authorized, the gate will be automatically opened an authorized user will operate the system, which is the security guard/personnel. This proposed system is fully insured with public liability insurance of the school. It will also give a big help to the part of the vehicle users because of its smooth operation. Davao Oriental State College of Science and Technology is one of the schools that need this kind of automation. In implementing this real time application, the entry and exit operation of the school will be more secured, reliable, efficient, and convenient. In the present scenario of the campus main gate, the chain is hanged as a caution of the closure of the gate and dropped when the entry and exit of vehicle is sought to happen. There are plenty of vehicles entering the campus especially early in the morning The guards find a difficulty in distinguishing which one is authorized or not Consequently, they just leave the chain dropped on the ground to allow convenient entry and exit of the campus vehicle. Unfortunately, this cause the gate unclosed even when there is no vehicle. This research will help improve the inadequate procedure of the school's manual process in managing and controlling the entry and exit of vehicle. It will provide a system that prevents the unauthorized vehicle in entering the campus. It will also solve the difficulty of the security personnel in identifying the authorized vehicle that enters the campus.

The main objective of the study has to develop an automated vehicle entry and exit program for the main gate of Davao Oriental State College of Science and Technology. Specifically, the study aimed to provide a distinctive identity between authorized and unauthorized vehicles through the use of a personal computer and a stand-alone program that will control and manage the automation of the gate system; to provide timed entry for vehicles entering the campus through a visual application that automatically computes the total number of hours until the vehicle exits the campus, thereby aiding in monitoring the time spent by vehicles inside the campus; and to provide an interactive button for the manual opening and closing of the gate. The study wanted to provide the college an alternative system that is sophisticated in controlling and managing the entry and exit of vehicle in the campus. This will lessen the time and effort spent by the guard in identifying the entering vehicle. The college will have a reliable automated system that will work for 24 hours a day. The faculty, staff, and the students will be secured from the unauthorized vehicle, because the system will filter the entry The study helps individuals be safe from unauthorized people or unlawful endeavor Schools and company's facilities and important documents will also be protected and be in good hands from any untoward incidents. Having an automated gate in the community, unwanted incidents will be eliminated. The proposed automation only covers the main vehicle entry and exit of the campus gate Vertical-Lift gate is a type used in the study so as to simulate the real swing gate system of the college. A piece of personal computer and a stand-alone program are also used to control and manage the daily operation of the gate system The gate will automatically open and close to those authorized vehicle, such as owned by the faculty & staff of the college, and by the currently enrolled students. Visitors are treated with non-authorized vehicle and will have their access through the interactive button for manual opening and closing of the gate remote control used for opening and closing of the gate, video surveillance that identifies the physical appearance of the vehicle, the audio alarm system and a database program that keeps record of the gate operation are excluded in the study.

Methodology

The study made use of the Waterfall Model of Software Engineering Systems Analysis and Design Methodologies to develop an automated vehicle entry and exit program in the main gate of Davao Oriental State College of Science and Technology.

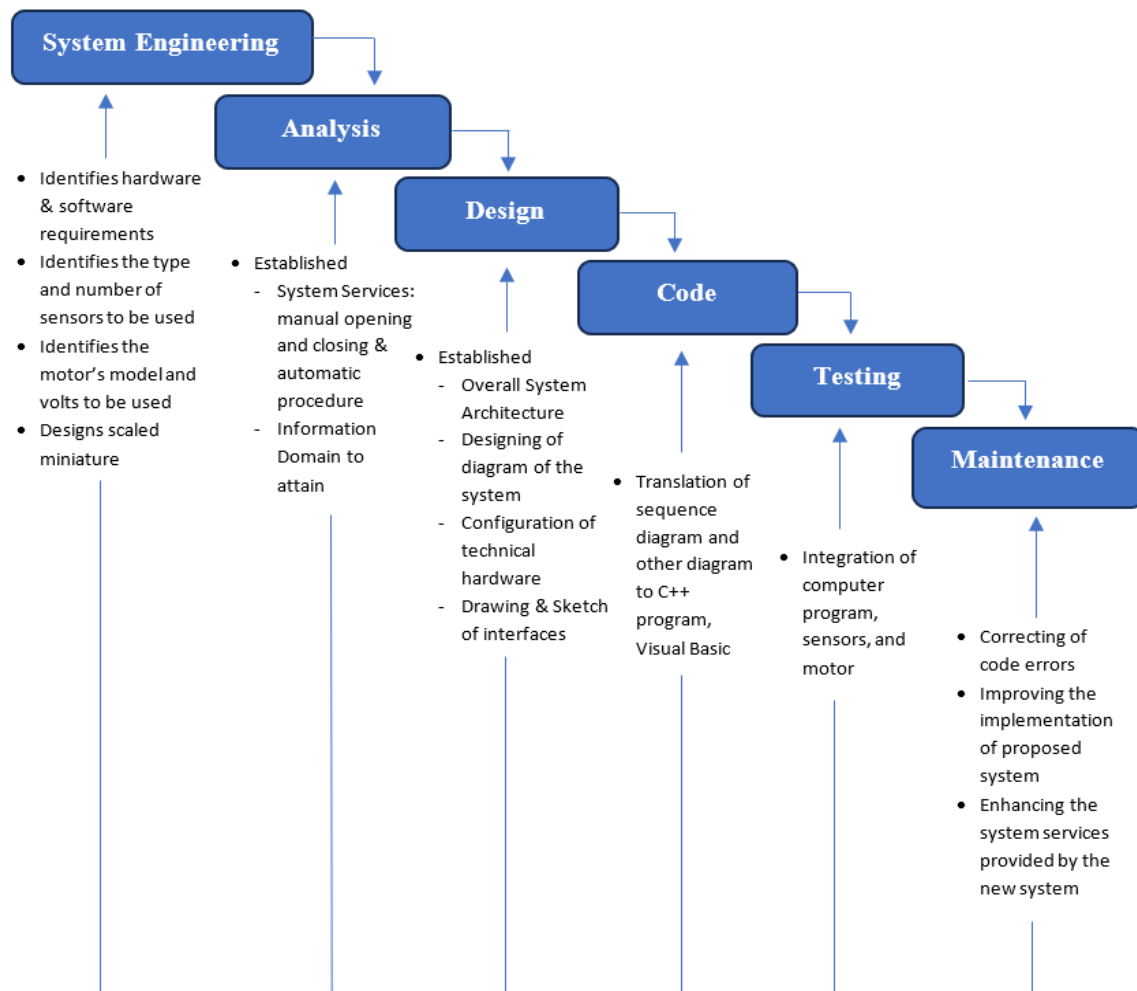


Figure 1. Projects waterfall model.

Results and Discussion

Data gathering procedures and outputs

The methods used in gathering data for the study were interviews, surfing the web, and library research. The respondents made a series of interview with the school's security personnel about some problems they encountered in the entry and exit system of vehicles. The information given by the personnel was then used in the proposal to apply automation to solve such problems. Through Internet, some codes and information that are useful and related from the study are gathered. Library research is also used in gathering some data that can be used in the study.

Documentation of current system

The Davao Oriental State College of Science and Technology main gate is located few meters away from the administration building. The college uses twofold swing gate that

accommodates the event of entering and leaving of vehicles. The gate is made up of a hard metal joined into a concrete base. Basically, this is towed by the guard personnel when there is a vehicle. Its base is beneath the gate where the guardhouse is constructed. The guard manages vehicle entry in the campus by pulling and pushing the gate. Due to some reasons, the guard initiated a non-realistic solution of managing the gate. This is putting a chain and attaching it to the post of the gate and is hang as a caution of closure of the gate and is dropped when needed to be opened.

Requirement analysis specification

Since software is always part of a larger system, the group began working by collecting explicitly all the requirements for all essentials of the system and allocating the functionality of each requirement to the software. The study made use of the D-type 25 pin Standard Parallel Port (SPP) (Figure 7-1). This port will allow input of up to 9 bits and output of 8 bits at any given time. The parallel port is formed by 17 lines and 8 earth lines [HARR, 1996] The lines of signals are in three groups. 4 control lines, 5 state lines, and 8 lines of data. These lines were used to interface, control and exchange messages from the PC to the project [PEAC, 20001].

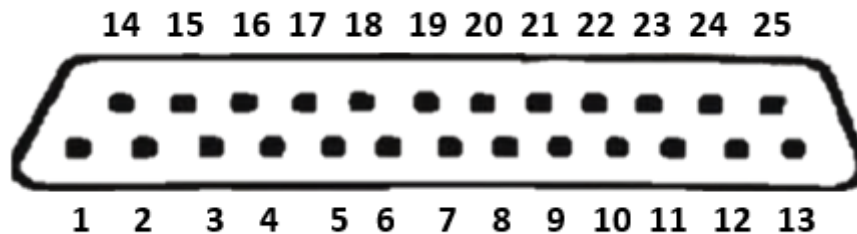


Figure 2. Description of DB25 Female connector.

The parallel port has three registers, the data register, status register, and control register. Each one of these lines (control, state, data) is indexed in an independent way by means of addressing, where each line register of the parallel port signifies one address. The data port register, which resides at the base address, is used for output signals. The status port/register is where the user reads or inputs signal from the project. The control port is used as the read/write port. In the project, it is utilized as additional input lines. For a typical PC, the base address of LPT1 is 0x378. The table 7-1 shows the register addresses of LPT1.

Table 1. Register addresses of LPT1.

REGISTER	LPT1
Data register (baseaddress + 0)	0x378
Status register (baseaddress + 1)	0x379
Control register (baseaddress +2)	0x37a

Almost all programming languages allow programmers to access parallel port using some library functions. But, visual basic, the program that is used, does not have any functions or support to access parallel port directly. However, it is possible to add such capabilities to VB application by writing a dynamic link library (DLL) in Visual C++ and calling its exported

functions from Visual Basic.

The program below is an example of a Borland C++ that best illustrates the basic code of interfacing the parallel port.

```
#include <stdio.h>
#include <conio.h>
#include <dos.h>
void main(void) [
    clrser( );
    outportb(0x378, 0xff);
    getch( );
```

The program shows how to send a byte to the parallel port output address. The outportb (), function sends byte to a specified I/O port. The first parameter is the value of the address of the port to write a byte The second parameter is the value of the byte to send [ENGD, 2005].

Registers are virtually connected to the corresponding lines. Whatever one writes to these lines, the registers are virtually connected to the corresponding lines as voltage, as well as reading of input from the sensor for instance, if ‘3’ is written to the data register, the data 0 and I will be driven to +5 volts [PEAC, 20001].

Obviously, the data lines are used to send output signal in managing the servo controller. Data line is assigned as one module in elevating the vertical gate up or down. Using an improvised sensor, specifically a Light Dependent Resistor connected into the status and control lines, signal was then sent to the computer.

Table 2. Parallel port signal lines.

Pin No. (DB25)	Register Bit	Color Code	Direction	Inverted
1	Control 0	Brown	Out	Yes
2	Data 0	Red	Out	No
3	Data 1	Orange	Out	No
4	Data 2	Pink	Out	No
5	Data 3	Yellow	Out	No
6	Data 4	Green	Out	No
7	Data 5	Light Green	Out	No
8	Data 6	Blue	Out	No
9	Data 7	Violet	Out	No
10	Status 6	Gray	In	No
11	Status 7	White	In	Yes
12	Status 5	Black	In	No
13	Status 4	White Black	In	No
14	Control 1	White Brown	Out	Yes
15	Status 3	White Red	In	No
16	Control 2	White orange	Out	No
17	Control 3	White Green	Out	Yes
18-25	Ground	-	-	-

Servo schematic diagram

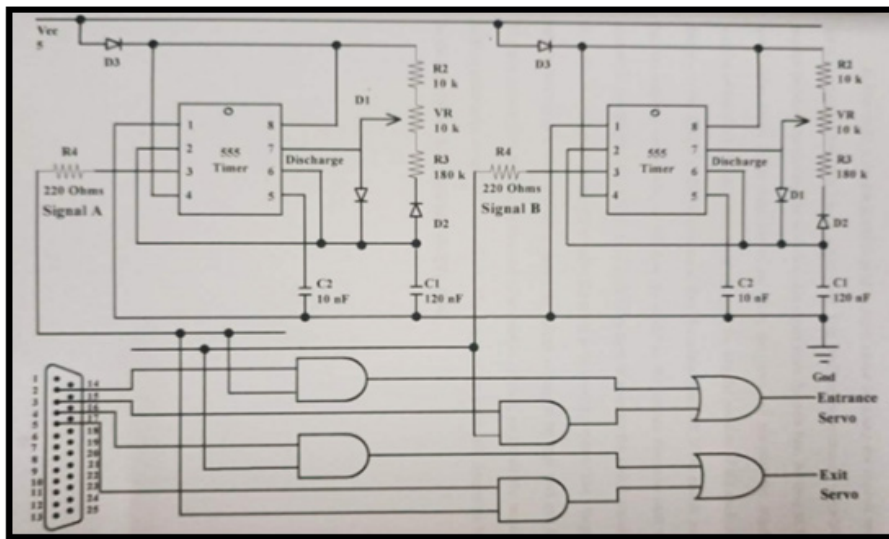


Figure 3. This diagram shows the connection of the data line, servo and 555 timer IC.

In this study, a Futaba S-148 is used as servo motor in raising the vertical gate. Servo is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal from the data line. As long as the coded signal exists on the input line of the servo, the servo will maintain the angular position of the shaft. As the coded signal changes, the angular position of the shaft also changes. If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor to the correct direction until the position is correct [MCMA, 1995]. 555 Timer IC is used to generate the coded signal or the series of clock pulses required to move the servo to its correct position. The charging and discharging of an astable 555 timer cause the output voltage to be high (5v) and low (0v) at a certain period. Through the use of a variable resistor, we create the required positive pulse. The length of the pulse will determine how far the motor turns the vertical gate [ROON, 1994].

Sensor and LED schematic diagram

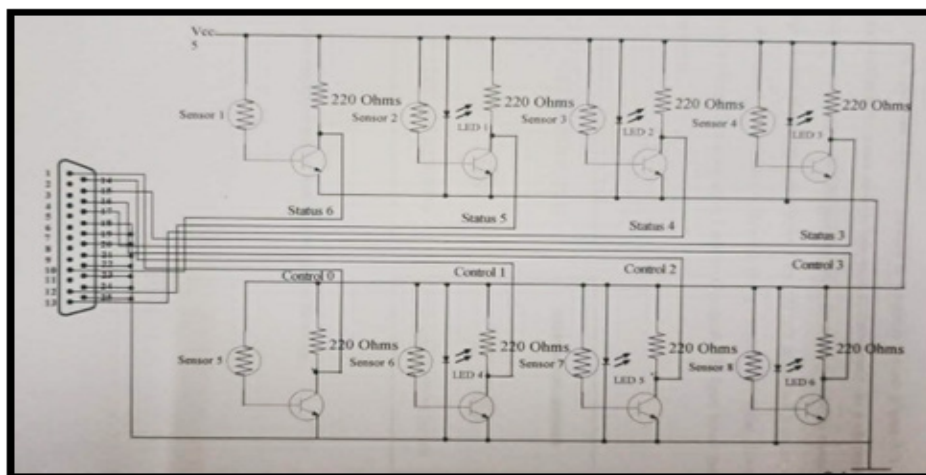


Figure 4. This diagram shows the connection of the sensors to their designated input lines and the connection of the light emitting diodes.

The sensor and LED were arranged in significant manner. Under normal condition, the sensor depends light from its environment. As a car passes and covers the set of sensors, the LED provides light to the sensor provided by means of the design of signal attached from the vehicle. If the LED light strikes back from the vehicle into the sensor, it allows current to flow thus giving a negative (0v) signal. However, if no light is reflected, the sensor sends a positive (5v) signal. The figure below illustrates this principle.

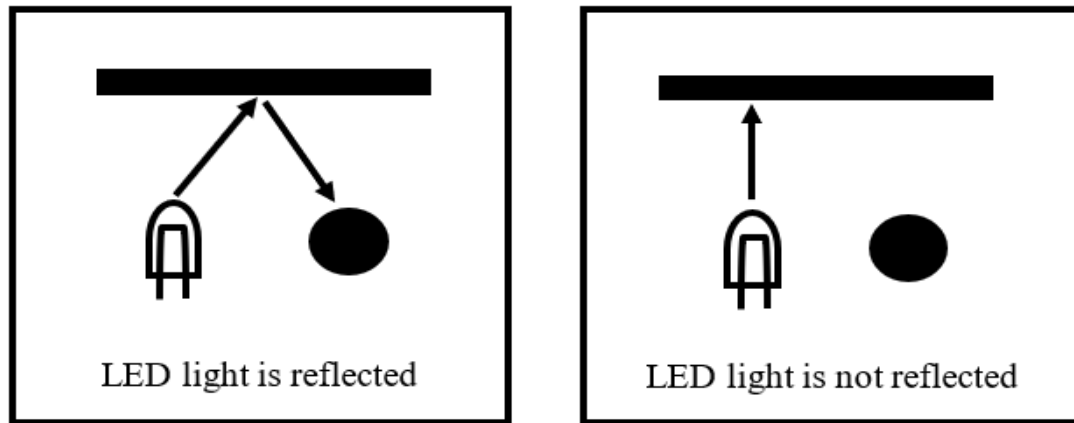
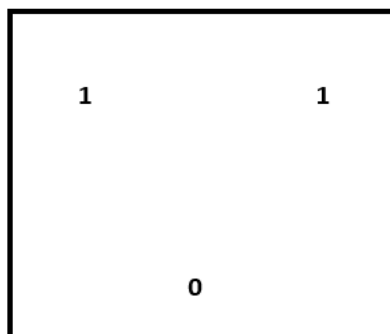
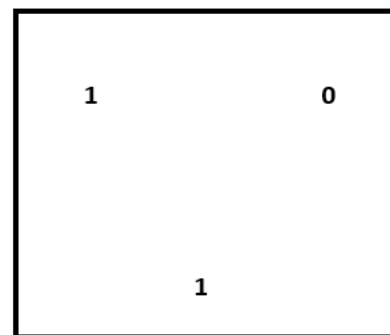


Figure 4. Sending of positive and negative signal to the sensor.

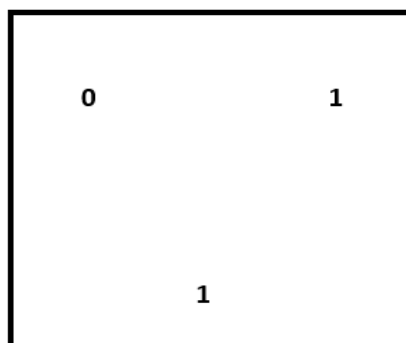
Through patterns of input signal assigned in every vehicle, the system identifies the incoming and outgoing vehicle in the campus. Below were the different patterns of signal assigned in every vehicle:



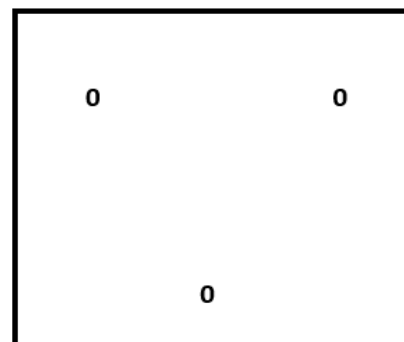
A.) Faculty



B.) Staff



B.) Student



D.) Unauthorized Vehicle

As the program identifies the authorized vehicle, it also keeps record of the time of entry and exit of vehicle and the required 6 hours service to be rendered by each faculty member as well as the 8 hours service for the staff. The program gets each time of duty through calling the built-in system time, as they enter and leave the college. The system requires a pass slip when the faculty and staff do not reach their number of required hours.

Physical arrangement of the LDR sensor and LED

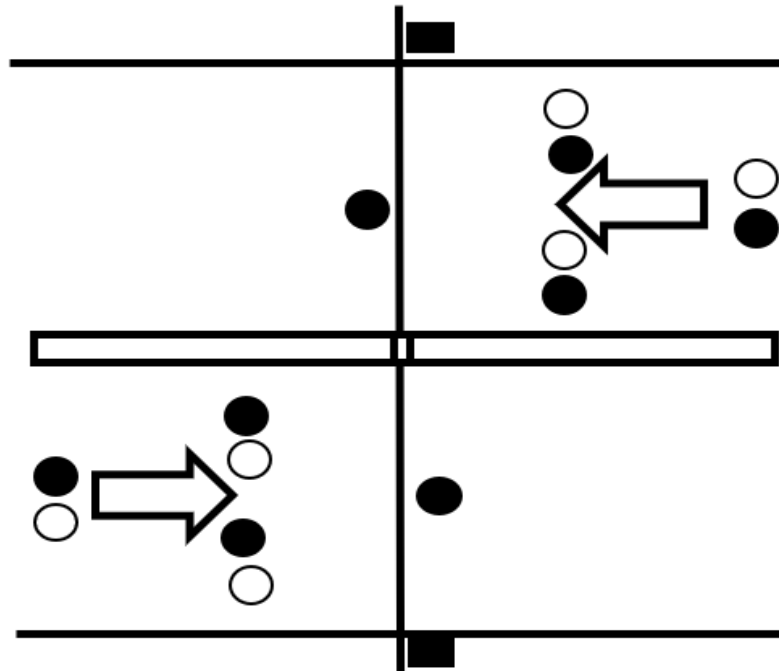


Figure 5. This diagram shows the arrangement of the LDR sensor and LED inside and outside the gate.

Data flow diagram

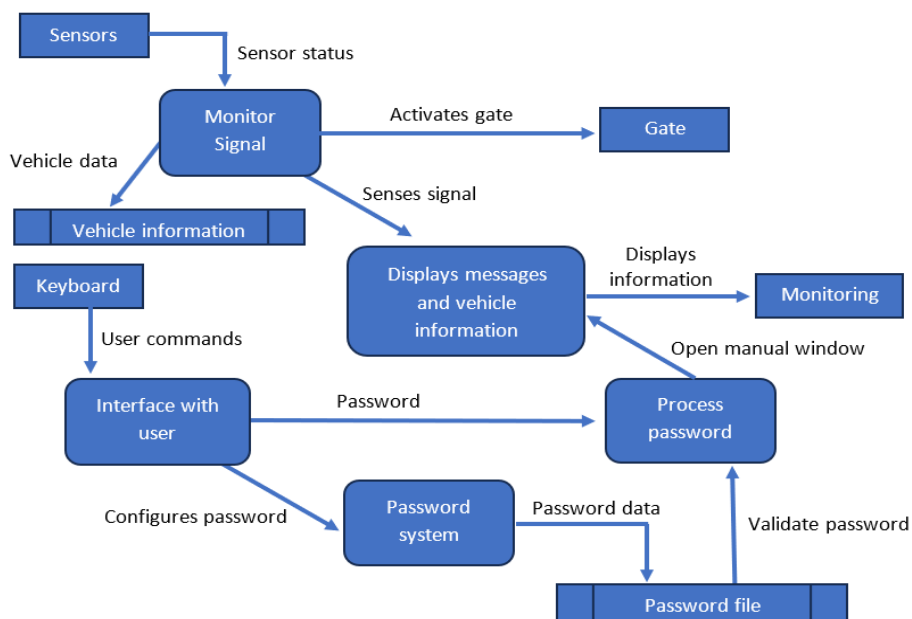


Figure 6. This diagram shows the data passage of the system from input to output.

The sensor drives the input and the gate serves as the ultimate output. Through the system process, the incoming signal is transformed into outgoing signal.

Context diagram

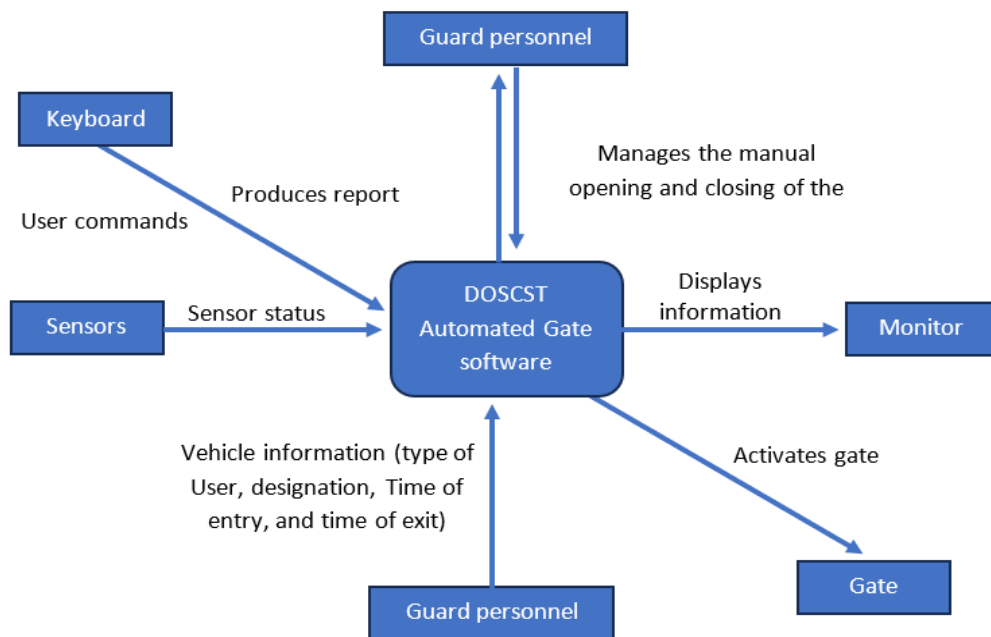


Figure 7. This diagram shows the data flow to all entities, which are transmitted with commands/signals from the guards and sensor respectively.

This context diagram also shows the information provided to and receive from external entities identified. The arrows represent the information received or generated. The closed boxes represent the set of sources or drop of information.

Physical diagram

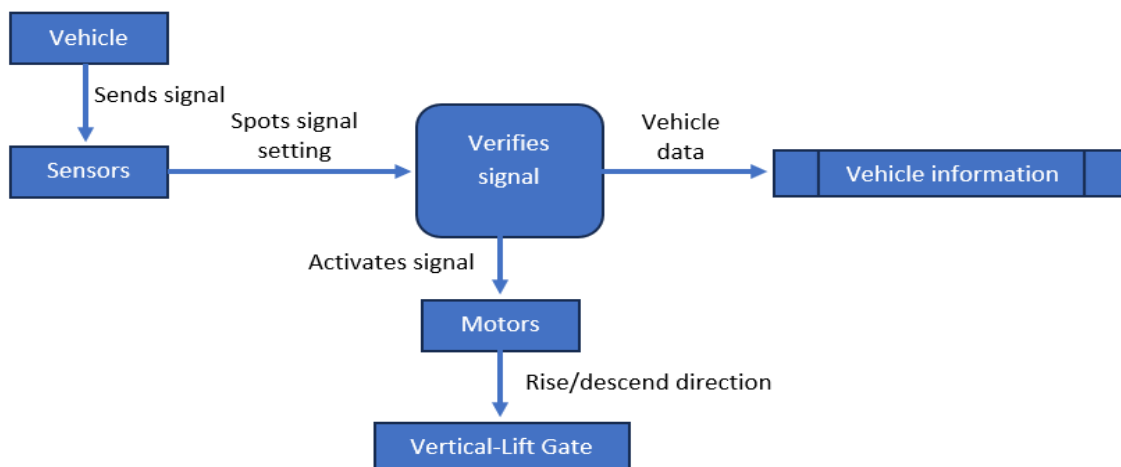


Figure 8. This diagram shows the physical component of the input (vehicle, sensor) to output (motor, gate) from a physical process and indicates storage action such as updating of vehicle record.

Logical diagram

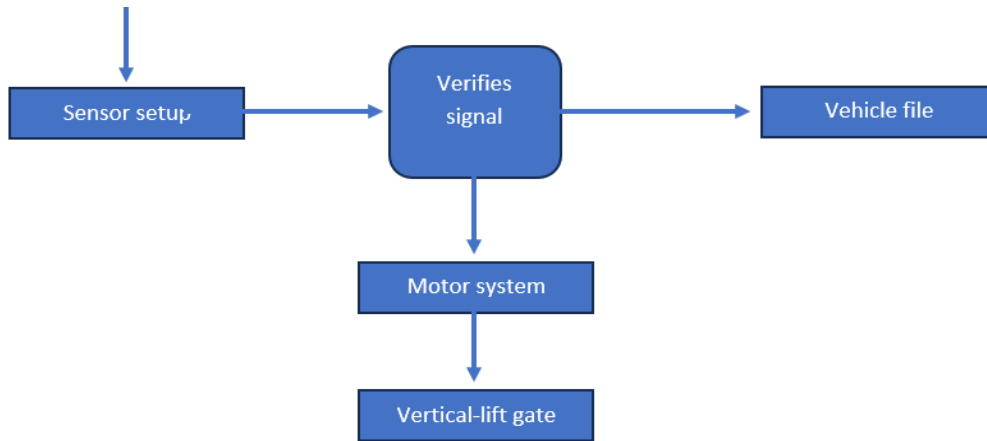


Figure 9. This diagram is concerned with what is being done in the system, in the absence of the physical components.

System flowchart

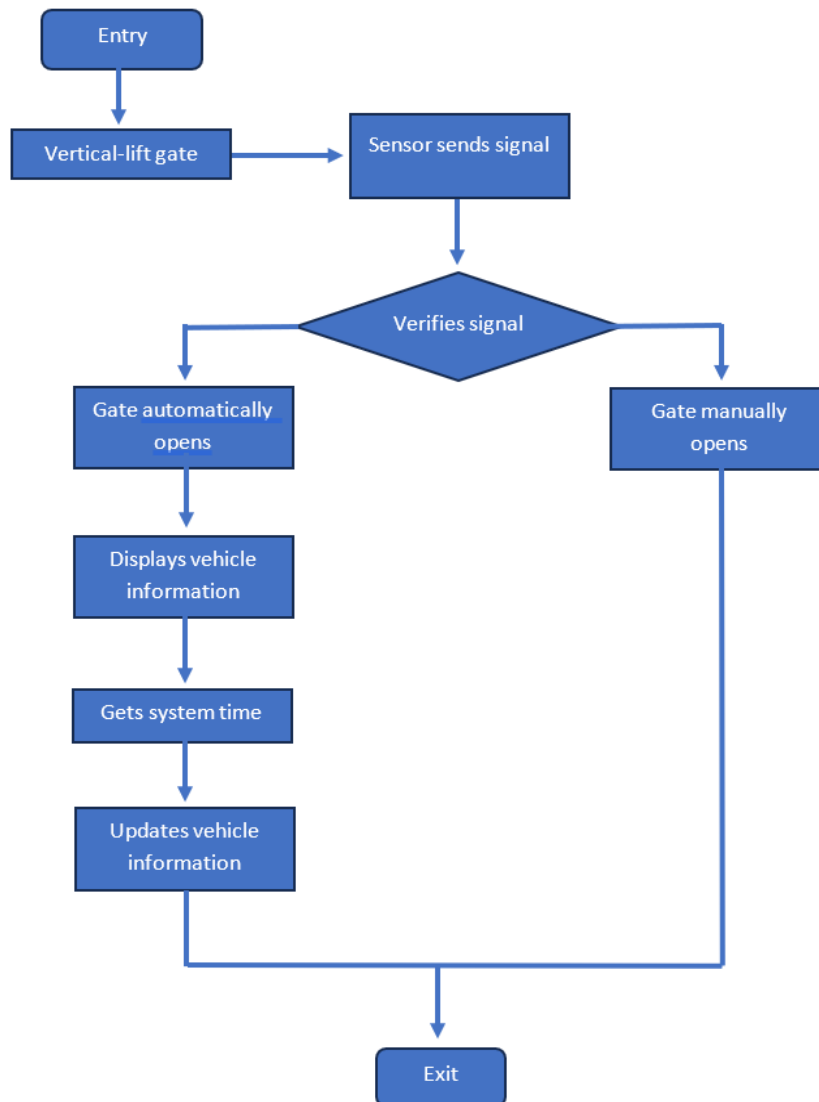


Figure 10. This diagram shows the processes and decision of the system.

As depicted, if a valid signal, is given the gate will automatically open and the system displays vehicle information, gets system time and updates vehicle information. If the signal is not valid the system requires the use of manual procedure in opening and closing the gate.

Sequence diagram

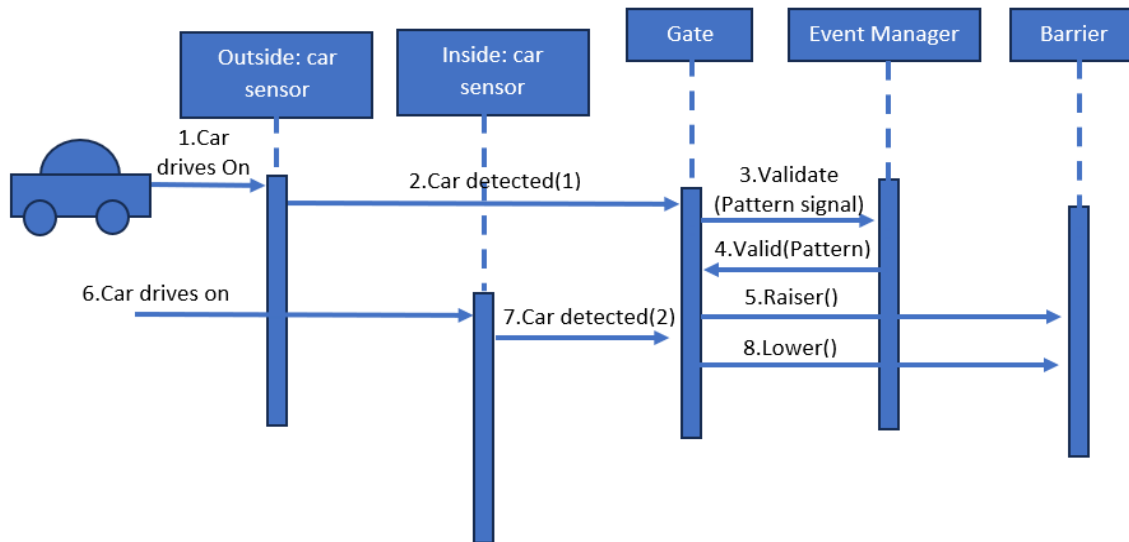


Figure 11. This diagram shows series of events that happen in the system as the car moves on from the outside sensor to the sensor inside the gate.

State transition diagram

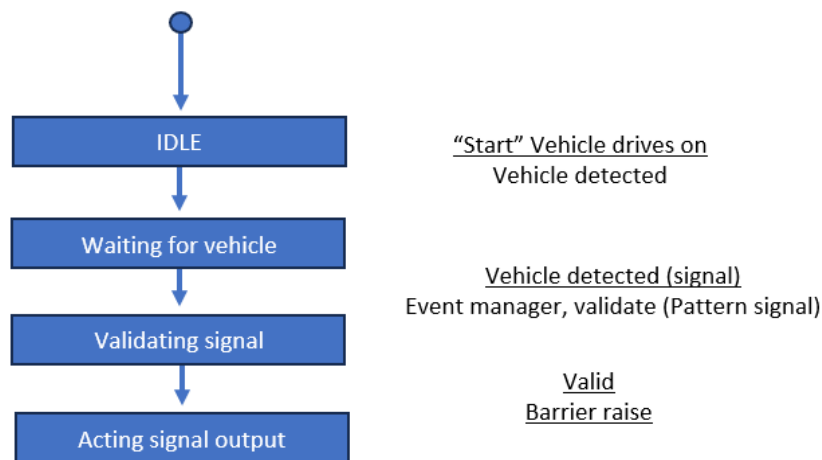


Figure 12. This diagram shows the behavior of the system as it changes from one state to other.

From the initial state, the system is “Waiting for Vehicle” as a vehicle is detected, the system “Validate Signal” occurs. When this happens, the transition to the “Acting Signal Output then is executed.

Conclusion

The automation of the school’s vehicle entry and exit helps improve the manual procedure of the college. It is a more reliable system for it will give a smooth and fast operation. It ensures security of the college because after opening the gate and as the vehicle enters the campus, the system automatically closes the gate. Only the authorized guards/personnel can use the system

for they are the only ones who know the password of the system. The implemented system will help the college in monitoring the school's faculty and staff schedules of duty for the system will provide a visual application that records their time of entry and exit in the campus. The system also provides a manual opening and closing of the gate that is used for the access of non-authorized vehicles.

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