

**Arduino Based Fire Alarm System with SMS Notification for
College of Tagaytay Senior High School**

**A Capstone Project
Submitted to the Faculty of
School of Computer Studies
City College of Tagaytay**

**In Partial Fulfillment
of the Requirements for the Degree
Bachelor of Science in Information Technology**

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May 2022

Objectives of the Study

The study's main objective is to provide a system that will raise a warning and send a notification message when a fire is detected.

Specifically, it aims to:

1) Design and fabricate a prototype capable of raising the alarm in cases of fire occurrence. That is capable of:

- a. develop a device that, depending on the fire alarm level, provides the necessary alarms and notifications to prevent major damage.
- b. develop a system to ensure the safety of students, faculty, and staff from fire hazards.
- c. detect fire and access it to determine its fire level.

Having a notification feature by sending a short message to the registered number of the registered personnel.

To notify all the registered numbers of the registered person with the use of the SIM800 Module.

2. To fabricate the fire detector with the use of Arduino,
3. Test and evaluate the prototype system, and
4. Implement the functional prototype system in the organization.

Scope and Limitation of the Study

The study focuses on developing an Arduino Based Fire Alarm System with SMS Notification for the City College of Tagaytay Old building that will notify the authorized personnel and the Bureau of fire protection (BFP) if there is a fire detected. The system is intended to help all students and faculty members by assuring their safety from fire threats.

The study integrates a fire temperature sensor using Arduino Mega ATMEGA 2560. When there is a fire occurrence, the sensors can detect the fire with the help of Arduino to process and analyze the data that the sensor will be sent. The system can provide necessary SMS notifications depending on the fire temperature level. When the fire reaches the limit, the SMS notification will be automatically sent to the registered number. The system admin is the only one that can re-program the system.

The system used Arduino IDE to write and upload programs to Arduino compatible boards, LM35 Temperature Sensor, and SIM800 Module. The Arduino used is the ATMEGA 2560, with the Arduino servers as the central processor of the entire prototype. Arduino Mega has fifty-four (54) digital input/output wherein sixteen (16) pins are the analogs input, and fifteen (15) pins are PWM outputs. It is designed for projects requiring more input and output lines, sketch memory, and RAM. Once the sensors detect the fire temperature, it transmits the data to Arduino ATMEGA 2560 for the data processing to provide necessary actions depending on the fire temperature level. For the SMS Notification, The GSM Module will be responsible for sending the data via SMS. The GSM module that is used in the prototype is

SIM800L. The SIM800L module uses 850, 950, 1800, and 1900MHz frequency bands, allowing users to receive/send SMS or calls. It also uses a SIM card to establish a connection with the network.

As for the fire temperature, when the LM35 temperature sensor reaches 40°C or above, The microcontroller on the Arduino ATMEGA 2560 board will notify The GSM module to send an alert message to the user.

This study is limited to the City College of Tagaytay: Senior High School Building. The system cannot detect smoke and what object caused a fire. This system also does not have a water sprinkler, and can only alarm and notify the people in the building. Only the authorized person will receive the SMS Notification when a fire is detected.

Significance of the Study

The study entitled Arduino-based fire alarm system with SMS Notification for City College of Tagaytay provides an automated fire alarm system for the Senior High School Building. The study improves on the traditional fire alarm system.

The target beneficiary of our system are the students and faculty members of the City College of Tagaytay since, based on the research, there is no existing fire alarm in the college building in the City College of Tagaytay.

The assigned system administrator is the researcher; the users are the beneficiaries, all students, faculty staff, and City College of Tagaytay members.

This study would give users peace of mind knowing that the system is automated and automatically detects fire.

The researcher developed the Arduino-Based Fire Alarm System with SMS Notification to prevent a possible fire occurrence, which is loss of lives and property. This study is beneficial for the following:

Users – City College of Tagaytay; Senior High School. They can use this system to protect lives and properties.

Bureau of Fire Protection (BFP) – The system will help them in their job. The system will help find out if there is a fire outbreak in the area.

Researcher - This benefits the application through the insights they would gain from this research. They could improve their skills and gain more knowledge about applications and hardware. It would help them grow as individuals, manage their time, and be responsible enough to meet demands within a given period of time.

Future Researchers - They can use it as a basis gather more ideas that they can use in their research to improve or do better in their research.

Additionally, this study can serve as a reference for future researchers that can inspire them to explore Arduino. It can also give them knowledge and ideas on how to improve and automate the existing traditional system in our country with the help of technological advancement.

Theoretical Framework

The theoretical frameworks are a collection of interrelated concepts that will guide the researcher in developing the proposed study.

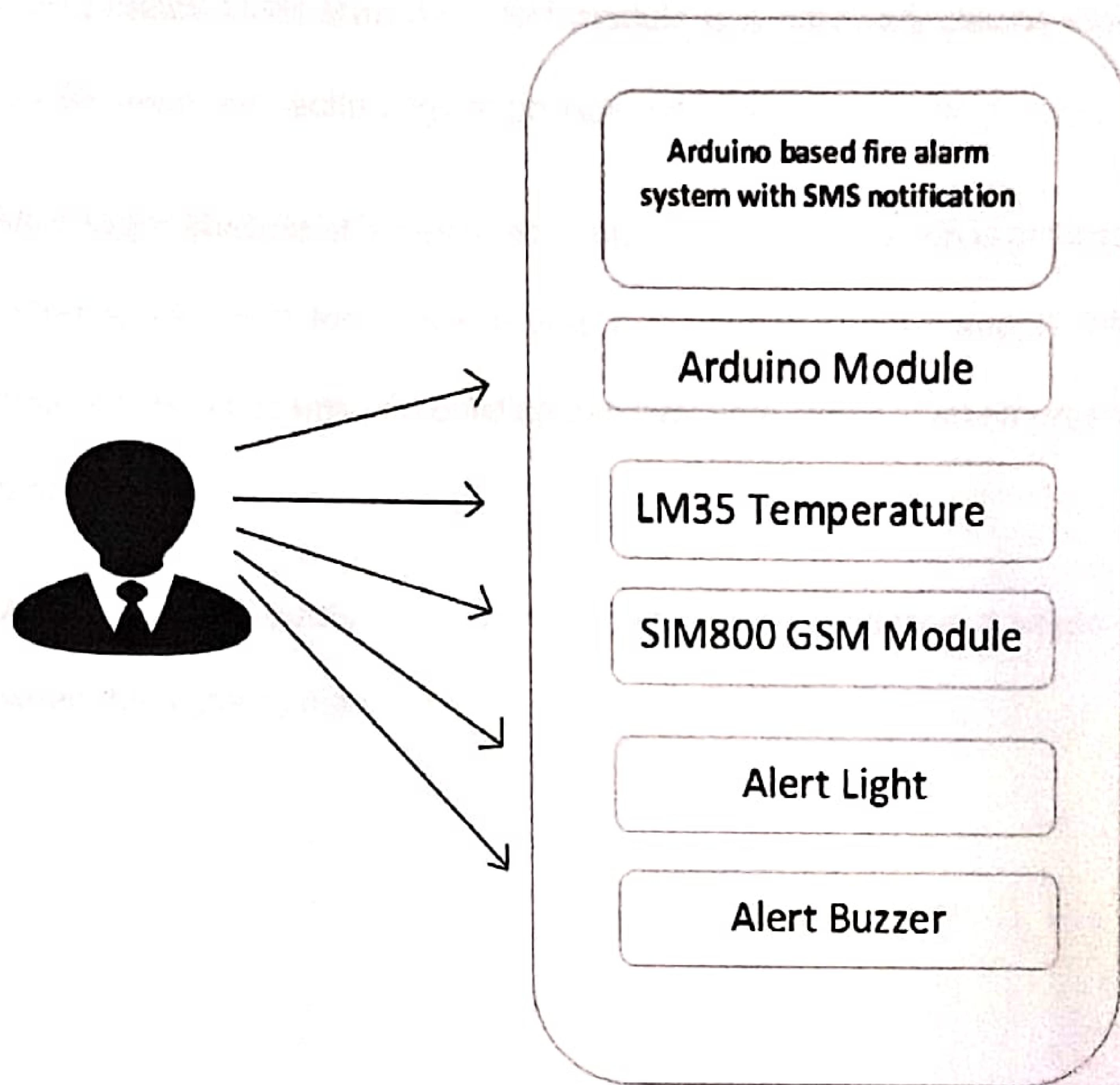


Figure 1. Theoretical Framework of Arduino-based fire alarm system with SMS Notification for The City College of Tagaytay old Building

Figure 1 shows the different modules of the Arduino-based fire alarm system with SMS Notification for The City College of Tagaytay old Building.

Arduino UNO Module. Arduino boards can read inputs - light on a sensor, a finger on a button, or a message - and turn it into an output - activating a motor and turning on an LED.

LM35 Temperature Module. LM35 Temperature sensor module is used for measuring the temperature in the immediate surroundings of the sensor. The sensor's output is an analog voltage proportional to the Celsius temperature scale. **SIM800 GSM Module.** GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network.

Alert Light Module. It is designed to ensure that illumination is provided promptly, automatically, and for sufficient time if the regular power supply fails. This will ensure that occupants of a building can evacuate safely in an emergency, such as a fire.

Alert Buzzer Module. The Alert Buzzer module produces a single-tone sound when the signal is high.

Conceptual Model of the Study

Based on the foregoing concepts, theories, and findings of related literature, studies, and insights taken from them, a conceptual model is developed, as shown below.

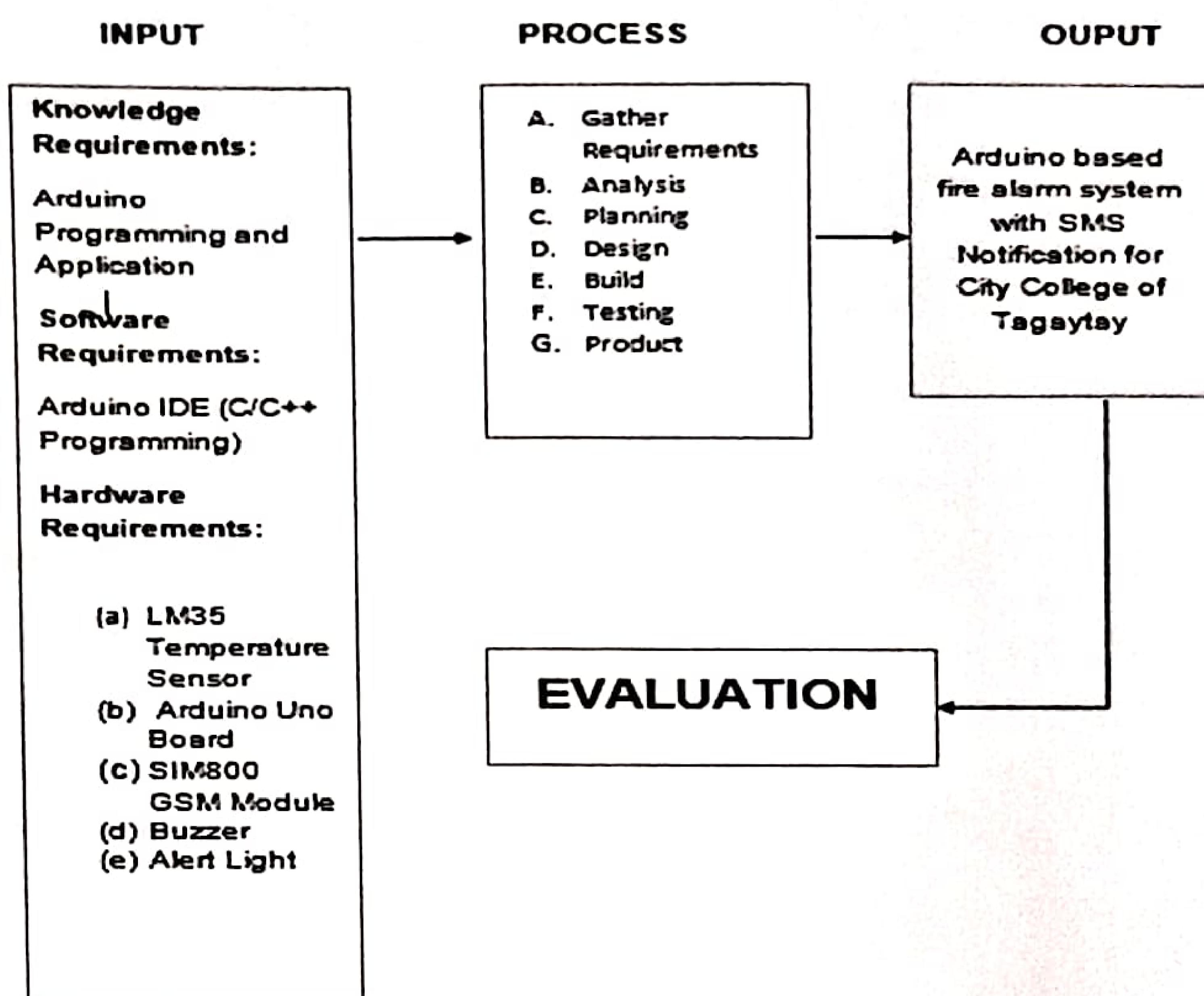


Figure 2. Conceptual Model of Arduino-Based Fire Alarm System with SMS Notification for City College of Tagaytay

As illustrated in Figure 2, the conceptual model shows the different stages of the processes involved in achieving the study's objectives. The proponents need to perform a survey utilizing an ISO912 standards survey questionnaire during the evaluation stage. Students and workers will evaluate the system.

Input Stage. The knowledge, software, and hardware requirements would go through numerous processes to create the Arduino Based Fire Alarm System with SMS Notification throughout the input phase. According to the knowledge requirements, Arduino is an open-source computer hardware and software community that creates single-board microcontrollers. Program statements (individual lines of code) are executed from top to bottom for the Arduino software requirement. Only flow control statements and the hardware required can change the top to bottom execution of statements. The Arduino Uno is an ATmega328-based microcontroller board. The LM35 is a temperature sensor that produces a proportional analog response to the current temperature. SIM800L is a small cellular module that can send and receive GPRS data, send and receive SMS, and make and receive voice calls. The buzzer is a little speaker that may be used with an Arduino.

Process Stage. In this stage is the methodology used in developing the system. Prototyping is the type of methodology applied in the system. There are six (6) phases. These are the following:

Gather Requirements

In this phase, the researchers recognized the issues by holding discussions and gathering needs to determine what type of quick design would be used as a guide in the fire alarm using Arduino. The use case diagram and prototype process are included in the project design.

Analysis

In this part, the researchers identify the problems wherein discussion and analyses were made in order to know what type of project design would be used. They would serve as the guide in developing Arduino Based Fire Alarm System with SMS Notification. The project design includes the use block diagram and Prototype Model.

Planning

In this phase, the researcher creates a project plan that would help the system in a specific time to finish. The project plan contains the task details and the completion time. The researchers researched to get some information related to the system used for Fire Alarm System with SMS Notification.

Design

Before entering the actual coding process, the researchers developed a project design to illustrate how the system would work and comprehend the system's requirements so that they could have a sense of what the final product should look like. This will act as a guideline for the system's development. This system design aids researchers in developing the overall system architecture by outlining hardware and system requirements.

Build

In this phase, after Designing the project, he researchers will build the assumed output of the system and test it as a final product.

Testing

The researchers tested the prototype several times due to hardware concerns, and the researchers determined that the prototype was working correctly during the testing procedure.

Product

A product needs to be user-friendly for the users to use it immediately. A product must be accurate to alarm when there is a fire inside the room immediately.

Output Stage.

The output stage of the study is the system that will be developed which is an "Arduino-based fire alarm system with SMS Notification for City College of Tagaytay."

Evaluation Stage.

The last stage, referring to the developed system, will be evaluated to ensure that the system satisfies the software quality characteristics as to its functionality, reliability, usability, efficiency, maintainability, and portability.

Operational Definition of Terms

Alarm System - An alarm system means any mechanism, equipment, or device which is designed to detect an unauthorized entry into any building or onto any property, or to direct attention to a robbery, burglary, or other emergencies in progress and to signal such occurrences by a local or audible alarm or by a silent or remote alarm.

Arduino - Arduino refers to an open-source electronics platform or board and the software used to program it.

GSM module - GSM modem or GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network.

SMS - is an acronym for "Short Message Service" and is the oldest, most widespread, and most frequently used texting technology that is supported by every single mobile network and device today.

Chapter II

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter describes the various elements that relate to the study and its operating system, its development tools, the fire detection system, and its module and GSM using Arduino.

Related Literature

Arduino Uno Arduino UNO R3 is a microcontroller board with 14 digital input and output pins 6 of them can act as PWM outputs and another 6 as analog inputs. It also includes a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller by simply connecting it to a computer using a USB cable or powering it with a DC adapter or battery to get started. There are A few types of Arduino boards are used nowadays, but the most commonly used nowadays are Arduino UNO and MEGA. The difference between these two is only the number of input and output pins. Arduino MEGA has a better number of input and output pins compared to 9 Arduino UNO. In this modern-day, Arduino is commonly used in microcontroller programming, among other things due to its user-friendly and easy-to-use setting; like any microcontroller, an Arduino is a small circuit board with a chip that can be programmed to do the numerous tasks. It sends information from the computer program to the Arduino microcontroller and finally to the specific circuit or machine with multiple circuits to execute the specified command.

According to Yusuf Abdullahi Bahamas, Arduino can help to read information from input devices such as sensors, antenna, and Trimmer potentiometer and can also send information to output devices such as LED, Speakers, LCD Screen, and DC motor. According to Shamsul Aizal Zulkifli and Mohd Najib Russin, Arduino also can be used as a microcontroller for 3 phase inverters while Tiffany Tang stated that there was also a project that linked Arduino with Kinect to control motion. This shows that there is so many applications an Arduino can be used for and in this project, Arduino will be used to process data gained from ph sensor before being transmitted to mobile phone. Arduino also will be used to turn on the water pump and motor. Arduino UNO R3 is a microcontroller board with 14 digital input and output pins, six of them can act as PWM outputs and another six act as analog inputs. It also includes a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller by simply connecting it to a computer using a USB cable or powering it with a DC adapter or battery to get started. There are a few types of Arduino boards that are used nowadays but the most commonly used nowadays are Arduino UNO and MEGA. The difference between these two is only the number of input and output pins Arduino MEGA has a better number of input and output pins compared to 9 Arduino UNO. In these modern-day, Arduino is commonly used in microcontroller programming among other things due to its user-friendly and easy-to-use setting, like any microcontroller, an Arduino is a small circuit board with a chip that can be programmed to do several tasks, it sends information from the computer program to the Arduino microcontroller and finally to the specific

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Addressable Fire Alarms Known as an “intelligent system,” these devices include both automatic and manual alarm options while monitoring all the alarms in the building. Although they are more expensive than a conventional alarm system, these systems can save large facilities time and money because if an emergency does occur, every element in the system is pre-assigned to its address that sends out a signal to indicate the exact location of the fire is occurring.

Developed Intelligent Fire Alarm System

We have developed an intelligent fire alarm system built to develop technology applications to commercialize fire alarm market demand growth. The system includes a control panel, alarm initiating devices, notification appliances, and the accessory.

Fire Detection System with GSM Using Arduino

Developed a fire detection system with GSM using Arduino. This system has an ideal gas sensor used to detect the presence of a dangerous LPG leak in any place like cars, service stations, cylinders, storage tanks, and homes, amongst other components. The Arduino Uno monitors the systems to identify the leakage of LPG. If the signal is high, turn ON an exhaust fan to remove gas from the area and send a message as "FIRE ALERT" to the registered mobile number.

Global System for Mobile communication (GSM) module

Global System for Mobile communication (GSM) module is planned for remote radiation checking through Short Messaging Service (SMS). This module is ready to get sequential information from radiation checking gadgets, for example, study meter or region screen, and send the information as text SMS to a host worker. It gives two-way correspondence for information transmission, status inquiry, and arrangement. The equipment comprises a GSM module, voltage level shifter, SIM circuit, and Atmega328P microcontroller. The microcontroller gives controls to sending, getting, and AT order handling to the GSM module. The firmware must deal with tasks identified with correspondence among gadget and host workers. It measures every approaching SMS, extracts and stores new arrangement from the Host, communicates alert/warning SMS when the radiation information reaches/surpasses limit esteem, and communicates SMS information at each decent stretch as per setup. Reconciliation of this module with radiation study/observing gadget will make portable and remote radiation observing framework with brief crisis alert at undeniable radiation level.

(Nur Aira Abd Rahman et al 2018 IOP Conf. Ser.: Mater. Sci. Eng. 298 012040)

Development of Fire Alarm System Using Raspberry Pi and Arduino Uno

The development of a fire alarm system using raspberry pi and Arduino Uno is a real-time monitoring system that detects smoke in the air due to fire and captures images via a camera installed inside a room when a fire occurs. This system can remotely send an alert when a fire is detected and will need user confirmation to report the event to the Firefighter using Short Messaging Service (SMS).

An SMS-Based Fire Alarm and Detection System

Izang, A. A, Ajayi, S. W, Onyenwenu, C. B, Adeniyi, F, & Adepoju, A. According to the development of fire alarm and detection systems. This system was built with the GSM module embedded in it, which helps end SMS (Short messaging service) to the homeowners and the fire service personnel when there is a fire outbreak before it gets out of range. Furthermore, this study provides a technology that would be accessible and affordable to the world at large so that homes, offices, and schools can adopt the use in other to protect lives and property. If and when the developed system is commercialized, it will help reduce uncontrolled fires by 50% because it warns of dangerous conditions before a fire outbreak.

A Multi-Sensor Fire Detection System Using an Arduino Uno Microcontroller

According to Zephaniah Shiwalo Obanda(2017) According to them, this implies that timely identification of a potential fire outbreak is crucial to managing it. Currently, most residential establishments, as well as business premises, are

not fitted with fire detection systems owing to a lack of awareness, high purchasing costs, and inefficiency of the devices given the high false alarm rates which have a cost attached to them, such as the unnecessary deployment of firefighting personnel. Fire detection devices are highly susceptible to false alarms because of reliance on one sensor that reads only one percent of the environment, for instance, smoke or heat. However, the advancement of the Internet-of-Things has led to the development of 'smart' technologies where multiple sensors can be incorporated into objects like fire detectors, enabling them to communicate wirelessly with other objects and carry out programmed tasks. This research aimed to propose prototype of a fire detection system using a multi-sensor approach. This research applied a rapid prototyping methodology for the development of the prototype. Data was collected from secondary sources and experimentation. The prototype used an MQ2 gas sensor, a Grove temperature sensor, a Grove light sensor, an Arduino microcontroller, a GSM, and a GPS shield. In the event of a fire outbreak, the device will be able to send an SMS alert to the homeowner as well as the firefighting department with GPS coordinates of the residence.

(Obanda, Z. 2017)

Smoke detector alarm system using GSM communication

According to Mregongka Chowdhury, Md. Ibrahim Sarker. GSM technology and telecommunication can be conducive to saving our lives and households from fire accidents, as shown in this project. We design and develop an Arduino circuit with a smoke detector, LCD Display, an alarm, and GSM shield. When the smoke detector detects smoke (the detect measurement of smoke can be configured

regarding the size and surroundings of the room), there is an LCD Display that shows "Fire in the room!" and the alarm rings immediately. Besides, there is a GSM shield where a SIM card is installed, and two phone numbers are programmed. The SIM card sends a message to the two phone numbers programmed in the system. So, someone can be aware of the fire accidents even if he/she is not in the home.

Design and Development of Automatic Fire Detection Using SMS and Voice Alert System

According to R.Sathishkumar, M.Vinothkumar, Devaraj Varatharaj, S.Rajesh, S.M.Gowthaman (2016), this system guides the usage of Fire extinguishers during the fire accidents. A Linear integrated LM35 sensor detects fire beyond preset value. The sensor units are connected via a standard data line to the PIC microcontroller. A GSM kit-based network module, capable of operating in standard GSM bands, has been used to send alert messages. Therefore, the system is called an eco-friendly system since the system is automated in such a way to replace the conventional practices during fire accidents. The proposed system describes the nature of the occurrence of fire and the system used to control them at the source. Keywords: fire detector, PIC16F77A, GSM Module, Voice Recorder, and Fire Extinguisher.

Using GSM SMS Controller Alarm Configurator to Develop a Cost-Effective Intelligent Fire Safety System in a Developing Country

The designed system responds to the smoke and cuts off the electricity supply. When a fire is detected, an alarm is turned on, and Short Messaging Service (SMS) alert is sent to the owner. After ten to fifteen seconds, the system

resends an SMS to the owner and the National Fire Service (NFS) safety officer giving the exact location. The call alert is sent to the owner of a facility and fire safety personnel, respectively, when the system is not reset. A microcontroller serves as the command center of the cost-effective, intelligent fire safety system. The circuit was designed and simulated using Proteus software, and the Global System for Mobile Communications (GSM) SMS Controller Alarm Configurator software was programming. The prototype was constructed and tested in real-time. The proposed system is cost-effective and will help policymakers, and save lives and property when implemented.

Arduino Integrated Development Environment (IDE)

Arduino Integrated Development Environment is a cross-platform application (for Windows, macOS, and Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino-compatible boards and, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many standards input and output procedures. User-written code only requires two primary functions, for starting the sketch and the main program loop, which is compiled and linked with a program stub main () into an executable cyclic executive program with the GNU toolchain, with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding loaded into the Arduino board by a loader

program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however, as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework.

GSM Based Fire and Smoke Detection and Prevention System

According to Mulubrenhan A. (2010), a fire alarm system plays a vital role in maintaining and monitoring the safety of all kinds of environments and situations. However, the usability of many existing fire Alarm systems is well known but could be produced at a high cost. Subsequently, it is not affordable for low-income users. The main objective of this project is to make a fire control system at a low cost. The project has three central systems: the detection system, the monitoring system, and the appliance system. The detection system operates as the fire detector and smoke detector. This paper discusses the design and implementation of a fire alarm system using the ARDUINO UNO R3, which operates the entire system. The detectors are placed in parallel at different levels. Any signal from each detector at any level is monitored using a monitoring system. The appliance system has components like GSM for sending SMS services, a buzzer for alarming, servos for an automatic lockdown of doors in emergency exits, and motor pump fire extinguishing foam to stop the fire, and a GPS module to indicate the occurred for the fire extinguishing car. The entire

flame, and heat; sensed by the detector, followed by the monitoring system, which indicates smoke, light, flame, and heat at that particular level. Finally, when the sensors from each level are triggered individually, the main Buzzer operates and sends SMS. Then it shows in the control panel LCD which area is affected and which is safe. Then it runs the emergency exit servo motor to escape and the water pump motor to the affected zone to stop the fire.

Related Studies

Local Studies

Arduino-based Disaster Management Alarm System with SMS

According to Angelo A. Beltran Jr (2020) et al., the Philippines suffered from an unlimited number of deadly typhoons, earthquakes, and volcano eruptions, making it a country prone to natural disasters. Natural causes are inevitable, but a warning device to alert people and prepare them for what is about to come is essential today. In this paper, the Arduino-based disaster management system is proposed. The device created is a disaster management device that consists of temperature, soil drift, accelerometer, tilt, and rain sensor. A hardware prototype model was developed. It is operated through the microcontroller Arduino and implemented using the C language. Experimental studies verify the effectiveness of the proposed method. If a sensor is activated, it will send data to the selected receiver, a mobile phone. Acquired data were provided in this article. Results reveal the effectiveness and efficacy of the proposed system. A future expressive directive has been incorporated at the end of this paper.

Design and Fabrication of Fire Fighting Autonomous Robotic System Equipped with Sensitive Sensors for Fire Alarm and Detection, Avoidance Behavior Mechanism, and SMS Messaging Capability.

According to Lester J. Resullar (2020) et al., According to them, the artificially intelligent systems applied to robots have been a part of our work environment, but it is not only limited to industrial automation. Recently, firefighting robots have been developed to mitigate disasters during fire accidents. In this work, a robotic firefighting system equipped with sensitive flame sensors, avoidance mechanism, alarm, and SMS capability is developed and designed, and Circuit design integrates several components into a microcontroller to successfully carry out its programmed task. The chassis's structural design accommodates all components for optimum performance. The codes were adjusted to see what was most efficient and fit the task. The Fire Fighting Robot with Alarm System has featured components such as Flame Sensor, Smoke Sensor, Ultrasonic Sensor, Piezo Speaker, LED, and Global System for Mobile Module and Mini Water Pump. Experimental results revealed that successful operation of the fabricated firefighting robotic system occurs. The optimal response time of the move stop was 400 ms. This suggests that the robotic system will start extinguishing the fire and automatically stop the pumping of water upon completely extinguishing the fire.

Furthermore, the installed ultrasonic sensor successfully sent a signal to the microcontroller to perform the avoidance mechanism of the robotic system from the obstacle. Likewise, the fire and smoke alarm detection and the SMS messaging capability were successfully activated upon the detection of fire and

smoke. This successful fabrication of a robotic firefighting system will be a potential mechanism for fighting fire disasters.

Design and Fabrication of Fire Fighting Autonomous Robotic System Equipped with Sensitive Sensors for Fire Alarm and Detection, Avoidance Behavior Mechanism and SMS Messaging Capability

Daniel Dasig Jr. According to him, the design has been developed since the social and economic cost of natural disasters, which has increased in recent years due to population growth, change in land-use patterns, migration and unplanned urbanization, environmental degradation, and global climate change. Catastrophic disasters include fires, earthquakes, volcanic eruptions, tropical cyclones, floods, and droughts. Fire is considered natural or man-made. Thus, the management shall provide safety for the building occupant. The design consists of five significant circuits to compensate for the system operation. It includes Detection and Initiating Devices (DEADS), Notification Devices (NODES), Central Station Monitor (CSM), Annunciation Devices (ANODES), and the Suppression Circuitry. The DEADS is composed of a smoke detector and smoke ionization sensors that transmit initiated signals to CSM. The NODES are active devices like smoke alarms and speakers attached to every room designed to give alarms to the room occupants. The Central Station Monitor, designed with Arduino Uno as the Microcontroller, served as the system's brain interfaced with PHP & MySQL. The ANODES work once a fire cannot be suppressed by the system itself, thereby when the fire department and other incident team needs to be contacted. The suppressor is composed of a robotic arm connected to the water supply, fire hydrants, and sprinkler heads.

Fire and Smoke Alarm System with SMS Notification Documents

A fire outbreak is considered a significant tragedy that must be avoided by any means due to possible results, which are loss of lives and property. Fire outbreaks when not controlled, may grow larger and may require days to put under control. In most cases during fire outbreaks, firefighters correspond in situations where the fire is already out of range. Uncontrolled fires were due to a lack and inefficient fire and smoke alarm systems that can be utilized to detect early and controllable fire occurrences.

Technical Background

Arduino Mega

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, and a power jack, an ICSP header, and a reset button

LM35

LM35 is a temperature sensor that outputs an analog signal proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius. The advantage of LM35 over thermistor is that it does not require any external calibration. The coating also protects it from self-heating. Low cost (approximately \$0.95) and greater accuracy make it popular among hobbyists, DIY circuit makers, and students. Many low-end products take advantage of low cost and greater accuracy and use LM35 in their products. It is

approximately 15+ years since its first release but the sensor is still surviving and is used in any products.

Fire Alarm Bell

Fire alarm bells used to produce public mode signals are designed to notify everyone in a given area or building of the alarm. On the other hand, private mode signals are designed only to notify people responsible for taking action during an emergency.

Jumper Wires

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. Attaching a jumper wire to the circuit can be short-circuited and short-cut (jump) to the electric circuit.

Bread Board

A breadboard allows for easy and quick creation of temporary electronic circuits or for carrying out experiments with circuit design. Breadboards enable developers to easily connect components or wires thanks to the rows and columns of internally connected spring clips underneath the perforated plastic enclosure.

Relay Module

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.

SIM800L GSM/GPRS Module

SIM800L is a miniature cellular module that allows for GPRS transmission, sending and receiving SMS, and making and receiving voice calls. Low cost, small footprint, and quad-band frequency support make this module the perfect solution for any project requiring long-range connectivity. After connecting, the power module boots up, searches for the cellular network, and logs in automatically. Onboard LED displays connection state.(no network coverage - fast blinking, logged in - slow blinking).

Chapter III

METHODOLOGY

Project Design

The project design serves as the framework for how the research is to be conducted. It specifies the research type and methods the researcher uses according to the main problem of the research.

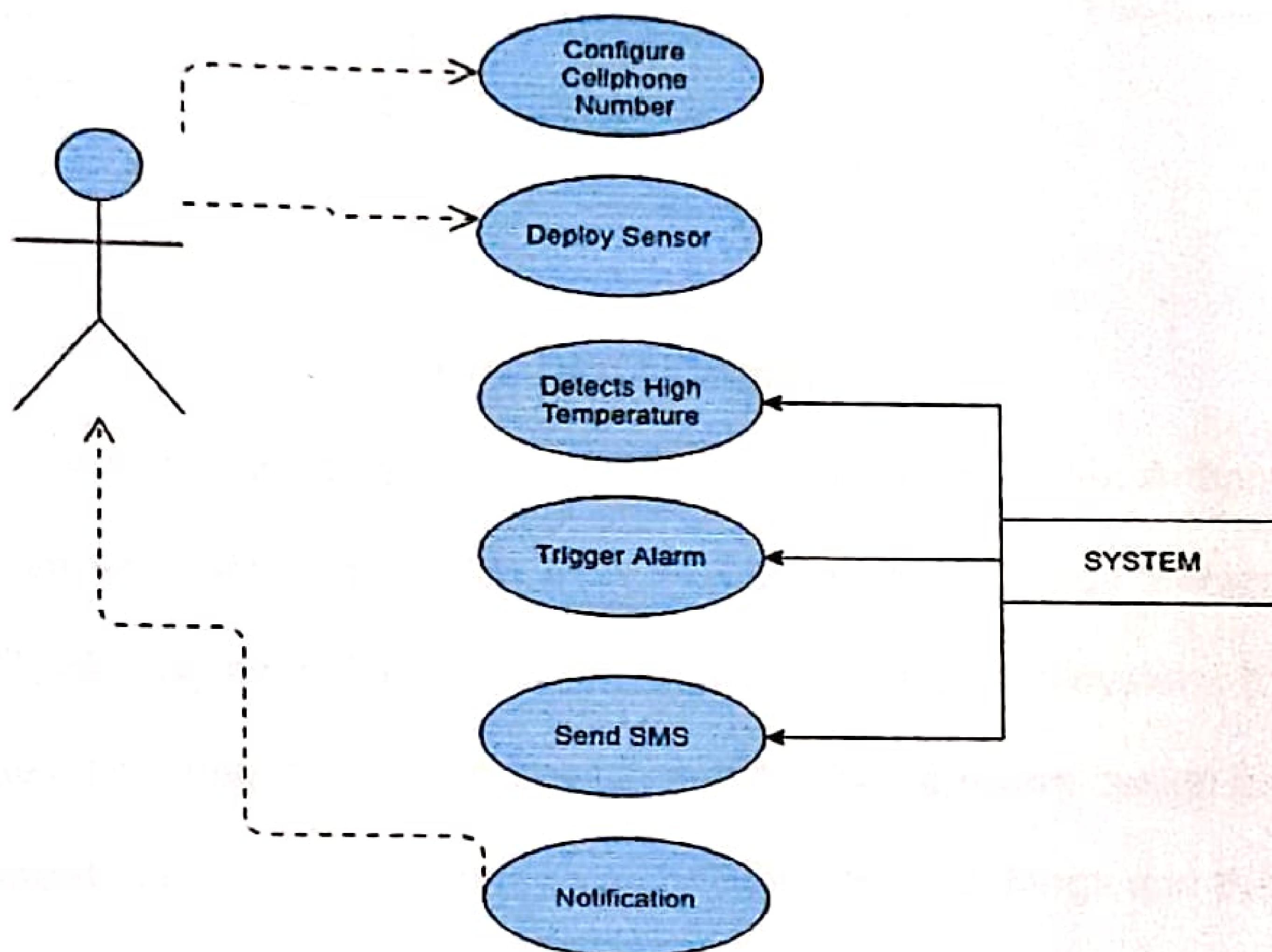


Figure 3. Use Case Diagram of Arduino-based fire alarm system with SMS Notification for City College of Tagaytay Senior High School.

The Administrator will configure the Cellphone number. After the configuration of the cellphone number, the Administrator will deploy the system.

In the system when the sensor reaches a high temperature, the system will trigger the alarm and will send the SMS Notification to the authorized cellphone number.

Block Diagram

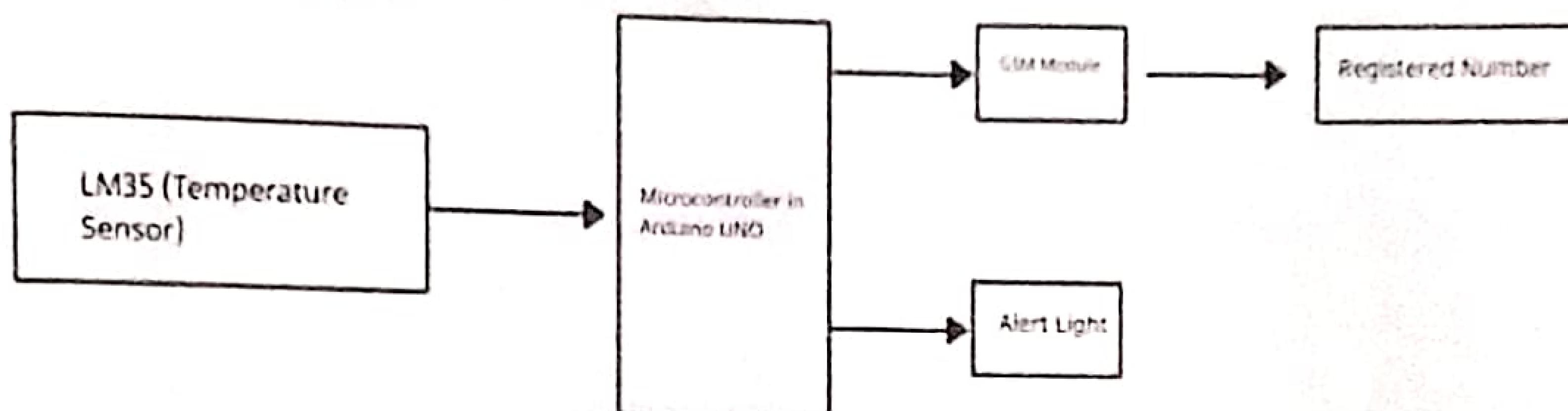


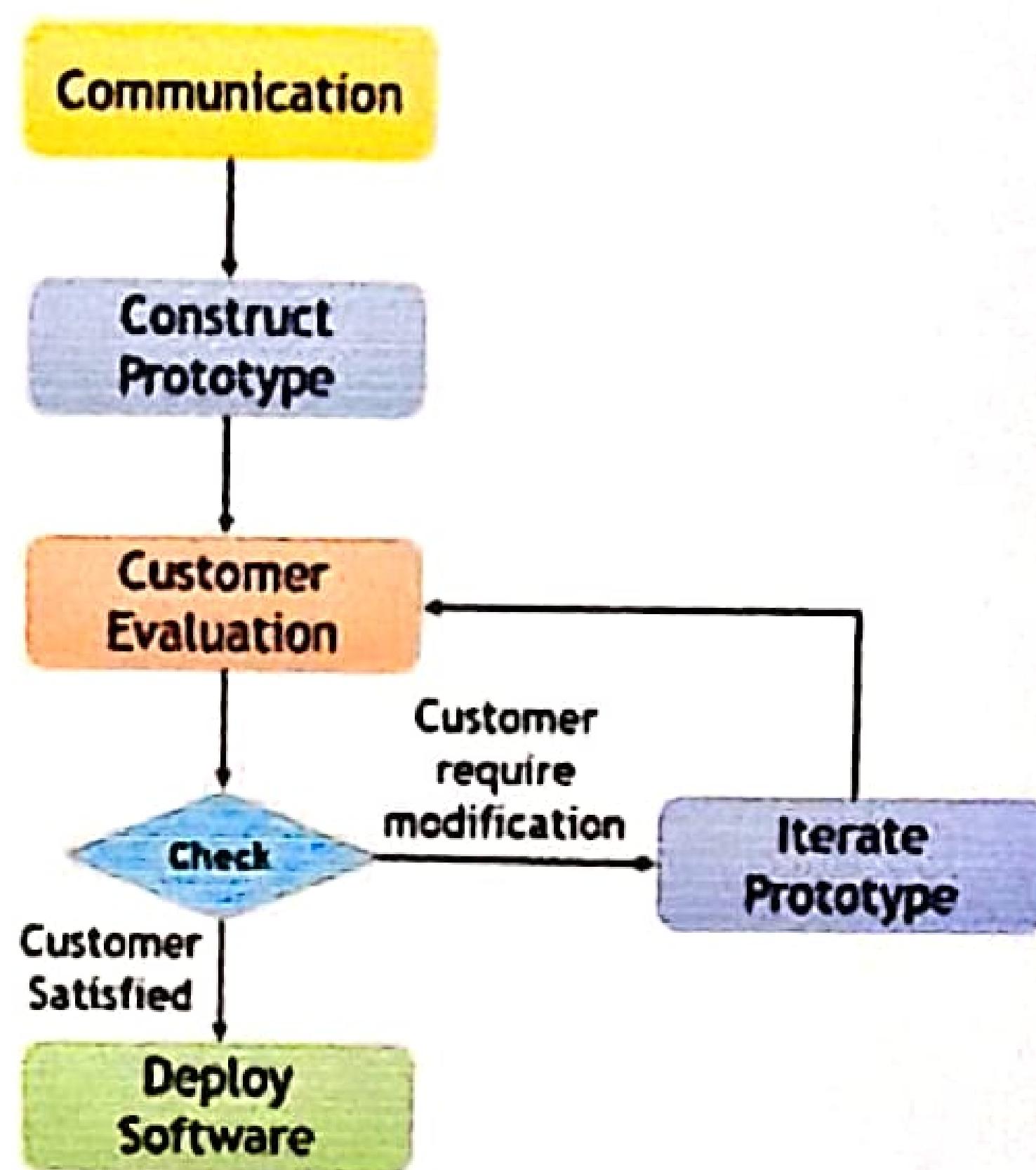
Figure 4. Block Diagram

Figure 4 shows the block diagram of the Development of the Arduino Fire Alarm system with SMS notification for City College of Tagaytay Senior High School. A Block diagram is focused on the input and output of a system. It cares less about what happens to get from input to output. The hardware design involves two components which are the connections between Arduino Mega and the GSM SIM900L with the temperature sensor, LM35. When there is a fire occurrence, LM35 will trigger the heat, it will directly send the signal to the Arduino informing the high temperature. When the temperature is increased Arduino will alert the user about the situation through GSM Module. An SMS will be sent to the user to let the user know the existence of the fire in the building.

To enable the system, the laboratory technician needs to plug the fire alarm system into the power supply.

Project Methodology

The Prototype model is a system development method in which a prototype is built, tested, and then reworked as necessary until an acceptable outcome is achieved from which the complete system or product can be developed. This model works best in scenarios where not all project requirements are known in detail ahead of time. It is an iterative, trial-and-error process that takes place between the developers and the users.



Prototyping Process Model

Figure 5. Prototype Model

(Source: Neha T (2020))

Figure 4 shows the prototype model of the Development of the Arduino Fire Alarm system with SMS notification for City College of Tagaytay Senior High School. The prototyping model shows six phases followed to meet the objective

set for the project. It is an iterative, trial-and-error process between the developer and users.

Prototype Model Phases;

Communication

In this phase, the researcher will gather data, discuss the product's needs, and meet the customer or clients.

Construct Prototype

In this phase, a simple system design is created, and this is not a complete design. The researcher gives an idea of the system to the customer.

Customer Evaluation

The proposed system is offered to the client for an initial evaluation during this phase. It aids in determining the working model's strengths and weaknesses. Customer feedback and suggestions are gathered and forwarded to the developer.

Iterate Prototype

The researcher starts altering the prototype based on the customer's suggestions and recommendations, and the modified prototype is then shown to the client for evaluation.

Deploy Software

This is the final phase of implementation, during which the system will be put to its complete capability.

System Operation and Testing Procedure

System operation and testing procedures refer to the evaluation process for testing the functionality and performance of each component and the entire system itself.

1. Connect the Arduino Mega to the computer. Once the Arduino is connected start the monitoring system.
2. After that, check the light indicator of the signal for the GSM module. Once the light indicator blinks every 3 seconds, it means that the GSM module established the signal and it's ready to use.
3. Once the prototype detected the set temperature, the prototype will alarm and notify based on the current temperature level.
4. Once the prototype automatically detects the fire temperature, the system will display the alert, and the buzzer will alarm for the sound notification.
5. Then, an SMS notification will be sent to the authorized person.

The following procedures may be conducted as follows:

1. Hardware Testing
 - a. Test the compatibility of each component based on its defined function.
 - b. Test if the device will turn on when the power has been supplied and the switch has been turned on.
 - c. Test if the microcontroller could process the data from the sensor and determine the fire alarm level.
 - d. Test if the buzzer for the audible alarm is working properly.

- e. Test the GSM Module if it can send SMS to the authorized person.

Evaluation Procedure

In the preliminary evaluation, the researchers will review all the necessary things/factors that will need in the completion of the system based on the system. Results will be analyzed to determine if the desired output is met through the given input. For the final evaluation, the sheet will be given to respondents. The comments, suggestions, and recommendations use to improve and enhance the system. The study used the Evaluation Criteria for software.

Table 1 shows the numerical rating and its equivalent interpretation to scale the result of the project evaluation.

Table 1. System Evaluation Sheet Numerical and Descriptive Scale

NUMERICAL RATING	INTERPRETATION	DEFINITION
4.21- 5.00	Excellent	The system fully meets and far exceeds the most expectations.
3.41- 4.20	Very Good	The system fully meets all and exceeds several expectations.
2.61- 3.40	Good	The system fully meets all expectations.
1.81- 2.60	Fair	The system does not fully meet all expectations.
1.00- 1.80	Poor	The system fails to meet expectations to a significant degree in several areas.

Gathered data will be computed using Mean Range Formula to conclude if the proposed system met the Software Factors Standard for Acceptance.