An Automobile Temperature Monitoring and Alert System Using Internet of Things [IoT]

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Abstract- *The aim of this study is to develop an IoT base system that can detect and monitor overheating in automobile vehicles using temperature alarm architecture. The objective of this study is to develop a constant beep alarm technology that can alert vehicle owners when the engine is overheating while displaying the temperature level on the vehicle dashboard, the system will automatically generate data on the readings of vehicle temperature and send to the storage device for future uses, to design an automatic diagnostic solution on the dashboard in case of emergency situation on engine overheating and to provide a system that can make monitoring and fast detection of vehicle engine temperature faster for the elderly (bad sight) and disabled persons. The motivation behind this study includes: lack of vehicle beeping alarm system which enable car owners to control the temperature and humidity gauge reading of their car and lack of immediate diagnostic measure when emergency on vehicle engine overheating occurs. The proposed system adopted the Object Oriented Analysis Design Methodology (OOADM), ARDIUNO IDE, DHT11 temperature and humidity sensor, and MYSQL XAMPP SERVER was used for the database design. The result was an IoT enabled device that was able to detect raise in temperature of a vehicle with a beeping alarm sign.*

Indexed Terms- Internet of Things, temperature alarm architecture, overheating of automobile vehicles.

I. INTRODUCTION

Vehicle is very important to every household more especially families with children and because of its crucial importance, one should not allow his or her own to damage because of a situation that can be handled. Because of climate change every vehicle should be monitored on the level of the temperature. Most vehicles have temperature gauge which is designed to measure the temperature of the engine's coolant. This gauge will indicate when the engine's coolant is cold, normal, or overheating. It is an important dial that is located on the dashboard of the vehicle.

When a vehicle temperature gauge reads high it means that the vehicle engine is overheating some might be because leakage or evaporation of the coolant. Another point or cause of the vehicle raise in temperature is when the car thermostat is broken or when the vehicle water pump or water pump gasket is bad. Also the vehicle temperature gauge might reads cold while the engine is still running for some minutes indicating that the thermostat is broken and needs to be replaced. Recently, Internet has involved in people's daily activities. Internet has been widely used to connect people together, people with devices, or devices with devices. In an electronics device, it is embedded by software and sensors for using to communicate and to exchange data with other devices and people. When multiple devices are connected together through the Internet, is called Internet of Things (loT). loT encompasses many new intelligent concepts for using in the near future such as smart home, smart city, smart transportation, smart farming and smart monitoring. In the aspect of detecting and monitoring the temperature and humidity of a vehicle more especially vehicles in Nigeria, require a technology that helps to detect overheating of the engine and immediately send an alarm to the driver (Beeping Sound) and also show

the reading on the vehicle dashboard. The scholars where able to identify the issues with vehicles in Nigerian due to the type of humidity of the nation for example, Nigeria has a very different climate; some part of the country has a very high hot temperature, while some cold. When the devices that are required to cool the temperature of a vehicle are faulty coupled with the hotness or coldness of the climate, it makes the situation had for anyone to handle. This study therefore identified the following problem in the existing temperature detection and monitory of vehicles: The inability of the elderly to see the temperature gauge, hence need for a beeping temperature gauge that could help them take necessary action.The significance of this study is not only based on delivering enhanced technological gadgets or smart systems to solve our human problems without mentioning the importance of IoT uses in providing intelligent systems around the world. Companies and government organizations cannot do without intelligent systems and with this, most modern vehicles are integrating IoT technology to ensure that quick and automatic response are achieved without human operation. Importance of sensors to detect and alert users of a particular device can never be over emphasized as they have added more intelligence to technological products and made connection amongst devices and other apparatus easier. This study will not only develop a monitoring and detection system on vehicle engine overheating, but is going to enhance already existing vehicles an extra monitoring strategy to ensure that their cars do not encounter engine overheating and also provide more job for the professionals. The elderly is not left out in this system, because of old age, most of our parents cannot see that very well, therefore if a system that can alert them on the level of the car temperature is provided, it will aid in resolving the problem faster.

II. LITERATURE REVIEW/RELATED STUDIES

It was the introduction of the internet and development of mobile devices that made it simple for the general public to start using computers and the internet resulting to the fast increase of software applications to solve problems of various kinds. In the aspect of connection of objects (computers, electronic devices and apparatus) brought about the concept of internet of things (IoT) as a new technology as stated by [1]. It was because of the introduction of IoT that social media sky rocketed and became the talk of town linking both big and small from various locations together, making it easier to share resources and idea [2]. As presented by [3], IoT was first used by a man called Kevin Ashton in 1998 during a presentation. This man made us to understand how important IoT will be when introduce, he was the man that saw the future on the introduction of IoT before MIT AutoID Lab in 2001 presented their contribution on IoT. Today most researches on IoT is focusing on the object around us how these objects can be used to better the society and make it a more beautiful place. It was on these notes that [4] defined an IoT as "An open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment". IoT involvement in our environment is a blessing for the computing profession and the entire society at large.

2.1 Architectural Design of Internet of THINGS (IOT)

An interconnected network of hardware (computers, sensors, and machines) and software (applications) that collaborate to automated and optimize operations is known as the Internet of Things, or IoT. [5]. In contrast, [6] categorized the Internet of Things (IoT) as a phrase used to describe a group of technologies that allow exchange of information between multiple devices that are connected to one another through a communications network. This network exchanges information and commands across the internet while also gathering, recording, and managing data to power the functionality of connected devices.In this study, in other to unveil the architectural design of an IoT as reported by [7] outline four (4) different layers of an IoT technology as follows: Sensor Layer, Gateway and Network Layer, management service layer, and application layer.

1. Sensor Layer
As presented by[8] this layer is the lowest architecture of the IoT technology consisting of the RFID tags and readers or any other soft sensors

which could be used or identified as the information or collection storage center.

2. Gateway and Network Layer

The gateway and network layer is the IoT layer responsible of transferring the collected information from the storage center which happens to be the sensor layer.

3. Management Service Layer

This layer acts as an interface between the Gateway - Network layer and the application layer; in bidirectional mode. It is responsible for device management and information management and responsible for capturing large amount of the raw data and extracting relevant information from the stored data as well from the real time data. Security and privacy of the data should be ensured.

4. Application Layer

This is the top most layer of IoT which provides a user interface to access various applications to different users. The applications can be used in various sectors like transportation, health care, agriculture, supply chain, government, retail etc.
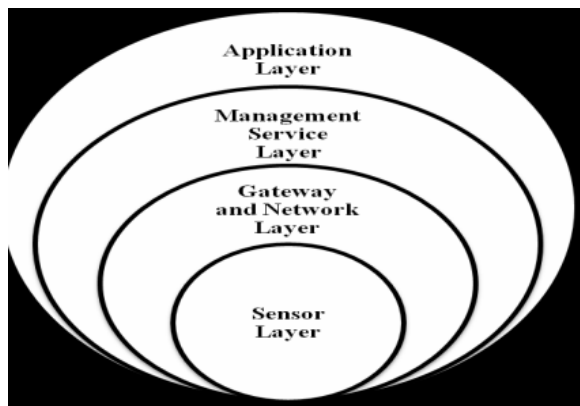

Figure 1: Layered Architecture of IoT [9]

2.2 Different Types of Car Sensors and Functions

According to [10] stated that modern cars have become a complex piece of machinery when compared to vehicles a couple of decades ago. A modern-day car comprises several electrical components as mechanical parts are getting replaced or aided by electronic devices.

2.2.1 Car Sensor

A car sensor is an electronic device that monitors various aspects of the vehicle and sends information to the driver or ECU (Electronic Control Unit). In certain situations, the ECU automatically makes adjustments to the particular component based on the information received from the sensor [10]. Sensors can monitor various aspects of a car, such as its temperature, coolant system, engine, oil pressure, emission levels, vehicle speed; the human sense organs (eyes, nose, mouth, tongue and hands) are the best examples to understand the working principle of sensors. They send signals to the brain, which then makes a decision. Similarly, car sensors send signals to the ECU to make appropriate adjustments or warn the driver. The sensors are constantly monitoring the various aspects of the car from the moment the engine is fired up.

In a modern car, the sensors are everywhere, from the engine to the least essential electrical component of the vehicle.Air-flow sensor, measures the density and volume of the air entering the combustion chamber. Engine knock sensormonitors engine knocking and ensures the air-fuel mixture is ignited correctly; Engine speed sensormonitors the spinning speed and position of the crankshaft, Camshaft position sensormonitors the position and proper timing of the camshaft, Manifold Absolute Pressure (MAP) sensor monitors engine load by measuring the difference between the manifold and outside pressure, Temperature sensormonitors the engine temperature.

2.2.2 Temperature and Humidity Sensor (DHT11)

To measure the temperature and humidity of an automobile vehicle can be achieved so as to be able to detect the temperature of the vehicle. There are so many types of sensors as state above. But this study adopted the temperature and humidity sensor called DHT11.

1. DHT11Sensor

The computerized signal yield is highlighted by the DHT11 temperature and humidity sensor. It is designed with an 8-cycle microcontroller that is superior. The high quality and spectacular long-haul sound are ensured by its invention. It has remarkable consistency, rapid response, hostile to the potential of obstruction and elite. Each DHT11 sensor contains an

extremely detailed dampness change chamber alignment[11].

2. DHT22 Sensor

The Sensor utilized here is DHT22 temperature sensor. This sensor consists of thermistor and basic advantage of using DHT22 sensor is that it is economical and light in weight. The sensor is interfaced with the raspberry pi using jumper wires. The temperature is sensed using the sensor DHT22 and is read, stored and displayed by the raspberry pi kit [12].

2.3 Related Studies

[13] Worked on vehicle Tracking and Monitoring System to Enhance the Safety and Security Driving Using IoT. Their study employed an embedded C programming language with an LPC2148. The monitoring of the vehicle was developed using SIM800 module with the Global Positioning System (GPS) and Global System for Mobile Communication (GSM).[14] presented an IoT Cloud Based Real Time Automobile Monitoring System, according to the scholar smart sensing approach has created a vibrant impact in shaping the future and the growth of technology which can be incorporated with the rising events triggering a need for a better lifestyle and Raspberry Pi and Machine Learning algorithm [K-Nearest neighbor (KNN) and Naïve Bayesian algorithm] for predicting the vehicle condition and life prediction of Engine, Coolant. Their proposed study integrated OBD-II in a FORD Manufactured car to extract the following data: Speed, air pressure, temperature, CO2 emission, GPS Coordinates, Fuel Level indicator sensor.[15] Worked on an Internet of Things (IoTs) based Intelligent Life Monitoring System for Vehicles. The study proposed a system which combines vehicle interior environment monitoring and emergency management mechanism. [16] Carried out a study on notifying and inspecting vehicle emission and temperature of vehicle engine. Their study proposed a system that can help to alert the vehicle owner for his vehicle emission of CO2, LPG gas leakage if the vehicle is being operated on gas and engine temperature of the vehicle so as to avoid vehicle failure due to overheating of the vehicle engine. [17] Worked on an IoT Based Smart Car Monitoring System, this is an "IoT based smart Vehicle monitor system". The system used IoT to monitor the vehicle by displaying the parameters alcohol level, smoke level, distance of object for black spot detection, rain intensity and light intensity through Wi-Fi. The study automatically detects the above parameters for the owner making it possible for the owner to avoid accident and other bad situations while on driving. On another study by [18] presented another design using an IoT based smart monitoring system for vehicles. [19] Presented an IoT based temperature and humidity monitoring framework. This study explored the use of Internet of Things (IoT) in monitoring the temperature and humidity of a data centre in real-time using a simple monitoring system to determine the relationship and difference between temperature and humidity with respect to the different locations of measurements.

III. ADOPTED METHODOLOGY

The use of vehicles is everyday life activity has always been a medium through which people make movement in a rapid and easy way. However, climatic changes, faults and malfunctioning of certain parts of the vehicle cause different issues for which this research has identified an aspect of it. Hence to achieve the aim and objectives of the proposed system, there is need to adopt a certain methodology that could lead to the desired procedure. Having analyzed the various methodological approaches, the study adopted the Object-oriented analysis and design methodology (OOADM) for the research because of its ability to provide an objected oriented design of both the proposed system and the existing system, it also allow the researcher to model the various function of the users on the platform using the use case diagram following the OOADM stages: Object-Oriented Analysis, Object-Oriented Design and Object-Oriented Implementation.

3.1 System Analysis

In system analysis, prevailing situation of problem is carefully examined by breaking them into sub-problems.

3.1.1 Analysis of the Existing System

The proposed systems adopt the temperature system gauge of vehicle and provide added features the existing system could not cover. Hence the existing

temperature gauge do not give notification inform of beep alert which will not only aid the elderly who cannot read the dashboard temperature gauge but also calls the attention of the driver, as there is tendency that his/her attention will be off the gauge. The existing systems only give an analogue system on the vehicle's dashboard which cannot call the attention of the vehicle user.
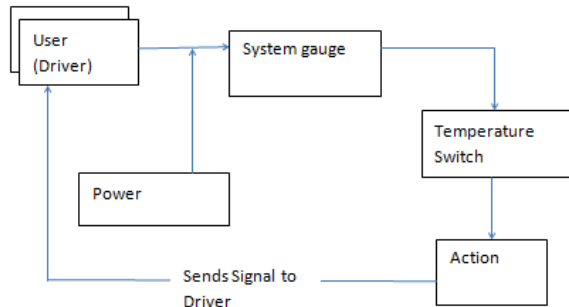

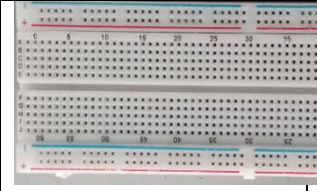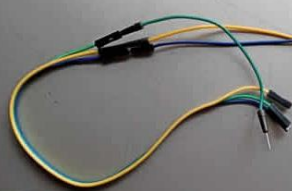Figure 2: Diagram showing analysis of existing system

3.1.2 Analysis of the Proposed System

The analysis of the new system talks about the operation of the added features on the monitoring system which is improving the temperature monitoring system. The new system could allow vehicle users to be aware of rise in temperature before the temperature rise results to overheating of the vehicle which eventually could cause serious damage to the vehicle. The new system also provides information storage ability for future use. Below is the analysis of the proposed monitoring system shown in figure 3 below: The proposed system uses an Arduino UNO Micro Controller board which controls the functionalities of the proposed system. ADHT11 sensor is connected to the controller, this sensor is responsible for dictation of temperature changes. Once a rise in temperature is dictated, the DHT11 will send back signal through the data cables to the micro controller which will initiate the beeping. A beep buzzer is used for the beeping and then the temperature status is stored in the database. The system is powered by the vehicle power system

3.1.3 Materials Used for the design

This materials listed in table 1 below are used for the development of the temperature alert system.

Table 1: Materials for the proposed system design.

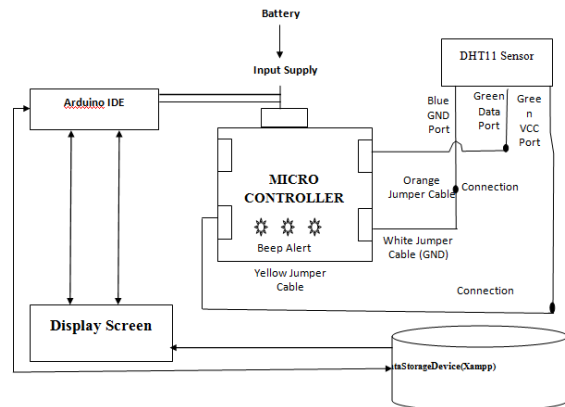| Breadboard use for the integration | Arduino UNO Board |
| DHT 11 sensor | Connection Jumper cables |
| Buzzer alarm device | USB cord for connection between computer and the Arduino UNO board |

Figure 3: Diagram showing the Analysis of the proposed system

IV. RESULTS
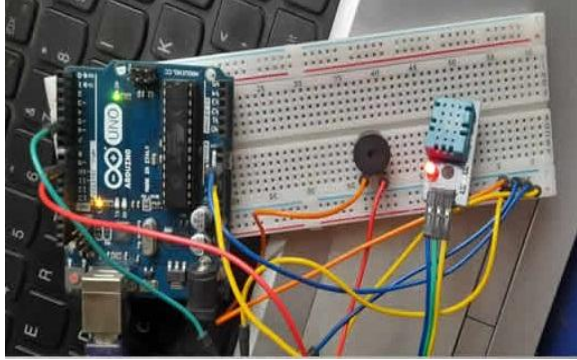

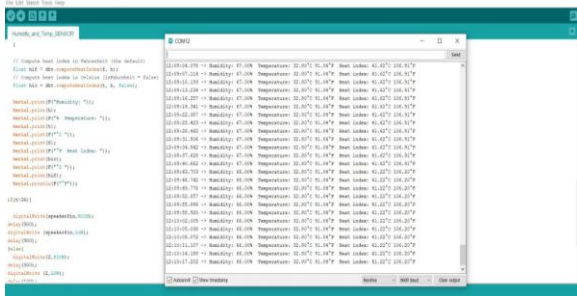Figure 4: Construction of the Temperature alert with beep sound design

Figure 5: The screen showing the code and result on the Arduino UNO board

CONCLUSION AND RECOMMENDATION

As earlier stated, that the aim of this work is to develop an IoT base system that can detect and monitor overheating in automobile vehicles using temperature alarm architecture. It is a clear design that was able to provide a smart alarm technique that will help both the young and elderly have a clearer sound and signal of the vehicles temperature and trigger appropriate action. Therefore, this study recommends that both local and international automobile companies and factories should apply the design in their future production if not already in place but should consider it later.

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