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Temperature and humidity monitoring and diagnosis system in vehicle engine by Using Internet of Things

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ABSTRACT

A temperature alarm architecture will be used in order to accomplish the objective of this research, which is to construct an Internet of Things base system that is capable of detecting and monitoring overheating in automobiles. A constant beep alarm technology that can aware vehicle owners when the engine is overheating while displaying the current temperature on the vehicle dashboard is the goal of this study. The system will automatically generate information regarding the readings of vehicle temperature and send it to the storage device for future uses. Additionally, the system will design an automatic diagnostic solution on the instrument panel in the event of an emergency situation involving the engine overheating. Lastly, the system will provide a system that can make monitoring and rapid detection of vehicle engine temperature faster for individuals who are disabled or elderly or who have impaired vision. This research was motivated by a number of factors, including the absence of a vehicle blaring alarm system that would allow car owners to regulate the temperature and humidity gauge readings of their vehicle, as well as the absence of an instant diagnostic measure in the event that an emergency situation involving an overheated vehicle engine happens. The database design for the suggested system was carried out with the assistance of the Object-Oriented Analysis Design Methodology (OOADM), the Arduino Integrated Development Environment (IDE), the DHT11 humidity and temperature sensor, and the MySQL XAMPP Server. A gadget that was enabled by the Internet of Things was developed as a consequence, and it was able to detect an increase in temperature in a car by means of a beeping warning sign.

INTRODUCTION

Every family, and particularly families with children, places a high value on their vehicles. Because of the critical significance of vehicles, it is imperative that individuals do not allow their own vehicles to be damaged as a result of circumstances that might potentially be detrimental controlled [1]. As a result of climate change, it is essential that the temperature of each and every vehicle be under constant surveillance [2-5]. The majority of automobiles are equipped with a temperature gauge that is intended to monitor the outside temperature of the coolant that is used by the engine. This gauge will tell if the coolant in the engine is cold, where it should be, or whether it is overheated. The central console of the car has a dial that is very significant and may be found there [6,7].

A high reading on a car's temperature gauge indicates that the engine of the vehicle is overheating. This might be due to a number of factors, including evaporation of the coolant or leaking of the coolant [8]. A further point or reason of the increase in temperature of the vehicle is when the thermostat of the vehicle is damaged, or when the water pump / water pump gaskets of the vehicle is no longer functioning properly. Additionally, if the temperature gauge of the car displays a reading of chilly even after the engine has been running for a few minutes, this is an indication that the thermometer is damaged and has to be changed accordingly. Internet use has been more integrated into people's routines in recent years [9,10]. Internet has been extensively used to link individuals with one another, as well as individuals with gadgets and devices with one another. An electronic device is equipped with software and sensors that allow it to communicate and share data with other devices and people. These components are contained inside the device itself. This phenomenon is referred to as the Internet of Things (IoT), and it occurs when a number of different devices are linked to the internet. One of the numerous new intelligent ideas that will be used in the not-too-distant future is the Internet of Things (IoT), which includes smart homes, smart cities, smart transportation, smart farming, and smart monitoring [11]. When it comes to determining and tracking the temperature and humidity of a vehicle, particularly vehicles in some countries, it is necessary to have a technology that can detect when the engine is overheating and immediately forward an alarm to the driver in the form of a beeping sound. Additionally, the reading should be displayed on the dashboard of the vehicle [12].

Due to the fact that some countries have a very variable climate, the academics were able to discover the problems that are associated with automobiles in the country. For instance, some countries have a highly different climate; this means that some parts of the country experience very high temperatures, while other parts experience low temperatures. As a result of the combination of the temperature of the environment and the malfunctioning of the systems that are supposed to be responsible for lowering the temperature inside of a vehicle, the situation becomes difficult for anybody to deal with [13]. Accordingly, the following issue was discovered in the current system for detecting and monitoring the temperature of automobiles, as established by this study: Due to the fact that older people are unable to view the temperature gauge, there is a need for a temperature gauge that emits a beeping sound in order to assist them in taking the appropriate actions. Without noting the relevance of Internet of

Things applications in the provision of intelligent systems all over the globe, the importance of this research is not just dependent on the delivery of improved technical gadgets or intelligent devices to solve our human issues. It is impossible for businesses and government agencies to function without intelligent systems [14]. As a result, the majority of contemporary automobiles are incorporating Internet of Things technology in order to guarantee that a prompt and automated reaction may be obtained without the need for human intervention. It is impossible to overstate the significance of sensors that are able to detect and notify users of a specific item. These sensors have significantly contributed to the enhancement of technical goods by adding intelligence to them and simplifying the process of connecting devices and other equipment.

This research will not only establish a monitoring and detection method on vehicle motor heating up, but it will also upgrade currently existing vehicles with an additional monitoring strategy to guarantee that their vehicles do not experience engine overheating. Additionally, this study will contribute to the creation of additional employment opportunities for experts from the industry [15]. Therefore, if a system that can warn them on the state of the car's temperature is supplied, it will help in fixing the issue more quickly. The elderly are not excluded from this system. This is because, due to their advanced age, the majority of our parents are unable to observe it very well.

2. Review of the Literature and Related Studies:

The proliferation of mobile devices and the arrival of the internet made it easier for the general population to start utilising computers and the internet. This, in turn, led to a rapid growth in the number of software programs that are designed to address a wide variety of issues. The notion of the internet of things (also known as the as a new technology was brought about as a result of the connectivity of items, which includes computers, electrical devices, and equipment, as was previously mentioned. Social media exploded & become the talk of the town as a result of the arrival of the Internet of Things (IoT), which linked both large and small businesses from different regions together and made it simpler to exchange resources and ideas on different platforms. During a presentation in 1999, a guy named Kevin Ashton was the first person to utilise the Internet of Things (IoT). He was the one who saw the prospects on the launch of IoT even MIT AutoID Lab gave its take on IoT in 2002. That is the man who helped us realise how essential the Internet of Things would be when it is introduced. At this time, the majority of study on the Internet of Things is concentrating on the items that are all around us and how these objects may be used to improve society by rendering it a more attractive place. In light of these considerations, the Internet of Things (IoT) was characterised as "an open and comprehensive network of autonomous devices that have the capacity to auto-organize, send and receive data, and resources, reacting and acting in response to situations and changes in the environment." The engagement of the Internet of Things (IoT) in our surroundings is a welcome development for the field of computers as well as for society as a whole.

2.1. Designing the architecture of the Internet of Things (IOT):

The Internet of Things, including everything often known as IoT, is a network that is comprised of hardware (computers, sensors, & machines) along with software (applications) that are networked and operate together to automate and optimise activities. A combination of technologies that enable the exchange of information among various devices that are linked to one another via a communications network is referred to as the Internet of Thing (IoT), which is a word that is used to define the Internet of Things. This network is responsible for the transmission of information and orders via the internet, as well as the collection, recording, and management of data in order to fulfil the functional requirements of linked devices.The purpose of this research is to reveal the physical layout of an Internet of Things (IoT) as described by outlining four (4) distinct levels of an Internet of Things technology. These layers are summarised as follows: the sensor layer, the gateway & network layer, the management service layer, and the application layer. The Architecture Layer of IoT is shown in Figure 1.

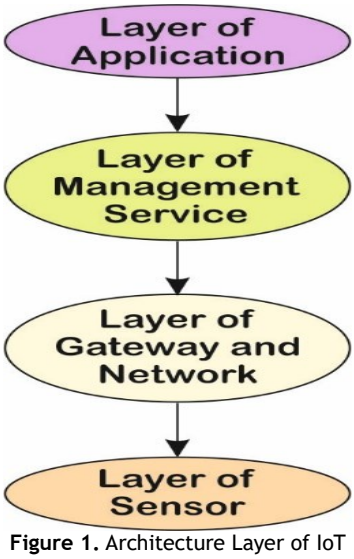

Figure 1. Architecture Layer of IoT

2.1.1. Sensor Layer:

In the IoT technology shown, this stage is the lowest level of design. It includes RFID tags and readers, as well as additional soft sensors that could be used as a data or collection hub.

2.1.2. Layers of the gateway and network:

It is the job of the gateway along with network layer in the IoT stack to send the data gathered by the storage centre, which is the sensor layer.

2.1.3. Service Layer for Management:

There are two ways that this layer can connect to other layers: the Gateway-Network layer along with the application layer. Its job is to handle devices and information, as well as to collect a lot of raw data and pull-out useful information from both saved and real-time data. It is important to keep the info safe and private.

2.1.4. Layer for Applications:

This layer is the highest one in the Internet of Things, and it is responsible for providing a user interface that allows people to access a variety of apps. Applications like this may be used in a wide range of industries, including transportation, healthcare, agriculture, supply chain management, government, retail, and many more.

2.2. Various Kinds of Car Sensors along with Their Uses:

That current automobiles have evolved into a more complicated piece of equipment when compared to automobiles that were produced a few of decades ago. There are a number of electrical components that are included in a contemporary automobile since

mechanical components are being replaced or assisted by electronic gadgets throughout time.

2.2.1. Sensor of Car:

An electronic device known as a car sensor is a device that detects different features of the vehicle and provides the driver or the Electronic Control Unit (ECU) with information about those characteristics. When certain conditions are met, the electronic control unit (ECU) will automatically make modifications to the specific component in accordance with the information that it obtained from the sensor. Sensors are able to monitor a variety of features of a vehicle, including its temperature, cooling system, engine, oil level, pollution levels, and vehicle speed. The human sense organs, which include the eyes, nose, mouth, tongue, and hands, are the greatest examples to comprehend the working concept of sensors. They transmit messages to the mind, which in turn decides what to do with the information. In a similar manner, the electronic control unit (ECU) receives signals from the sensors in the vehicle in order to make the necessary modifications or to notify the driver. Since the time the engine is started, the sensors are continuously monitoring the many different characteristics of the vehicle.

Sensors are included in every part of a contemporary automobile, from the engine to the electrical component of the vehicle that is considered to be the least important. A sensor that monitors airflow is able to determine the amount and density of the air that is reaching the combustion chamber. In addition to monitoring engine knocking, the engine knock sensor ensures that the air-fuel combination is ignited in the appropriate manner. The crankshaft's location and the speed at which it is rotating are all monitored by the engine speed sensor. The position sensor for the camshaft monitors the position of the camshaft as well as the time of its rotation. By monitoring the difference between the pressure within the manifold and the pressure outside, the Manifold Absolute Pressure which is sensors is able to monitor the load on the engine. Sensors that detect temperature monitor the temperature of the engine.

2.2.2. Sensor for Temperature and Humidity (DHT11):

The humidity and temperature of a car may be measured in order to determine the temperatures of the vehicle. This can be accomplished in order to detect the warmth of the automobile. As was said before, there are thousands of different kinds of sensors. Nevertheless, a humidity and temperature sensor known as DHT11 was used in this investigation.

Sensor DHT11:

The computerised data return is drawing attention to itself via the use of the DHT11 moisture and temperature meter. Additionally, the 9-cycle processor that was utilised in its production is superior. The music that is played across great distances is of a very high quality and is really remarkable because of its innovation. It has a high degree of consistency, a rapid response time, is against the concept of delay, & is controlled by a select group of people. Every single DHT11 sensor is equipped with an extremely accurate location of the water changing chamber.

Sensor DHT22:

The temperature sensor that is being used in this instance is a DHT22. This particular sensor is made up of a thermistor, and the primary benefit of using a DHT22 sensor is that it is both cost-effective and lightweight within its design. Jumper wires are used to connect the sensor to the Raspberry Pi in order to create an interface. It is the Raspberry Pi Kit that is responsible for reading, storing, and displaying the temperature. The temperature is measured by the sensor DHT22.

2.3. Related Research:

Contributed to the development of a vehicle monitoring and tracking system that uses the internet of things to improve driving safety and security. The researchers used an embedded C programming language in conjunction with an LPC2148 for their investigation. The GPS (Global Positioning System) and the Global System for Mobile Communication (GSM) were used via the utilisation of the SIM800 module in order to construct the monitoring system for the vehicle. According to the scholar, the Internet of Things (IoT) Cloud-Based Real Time Automobiles Monitoring System has created a vibrant affect in shaping the future along with the growth of technology. This approach can be incorporated into the rising events that trigger a need for a better lifestyle. Additionally, Raspberry Pi along with Machine Learning algorithms [K-Nearest neighbour (KNN) and Naïve Bayesian algorithm] have been utilised for the purpose of predicting the condition of the vehicle and the life prediction of the engine and coolant. OBD-II was incorporated into a Ford-manufactured vehicle as part of their planned research project in order to collect the following information: speed, humidity, temperature, CO2 emission, location on GPS, and fuel level indication sensor parameters.

Participated in the development of an Intelligent Life Tracking System for Motor vehicles that was based on the Internet of Things (IoTs). According to the findings of the research, a system that combines emergency management mechanism and monitoring of the interior environment of the vehicle was presented. An investigation into the alerting and examining of car emissions as well as the temperature of the engine of the vehicle. In their research, they presented a system that would be able to provide the owner of the vehicle with information on the emission of carbon dioxide (CO2), the leakage of LPG gas (LPG) if the vehicle is being driven on gas, and the temperature of the engine of the vehicle. This would assist to prevent the vehicle from failing due to the engine overheating. Internet of Things (IoT) Orientated Smart Car Monitoring Systems, also known as an "IoT orientated smart Vehicle monitor system" The Internet of Things was used by the system in order to monitor the car. It did so by presenting the parameters of alcohol level, smoking level, distance of item for black spot identification, rain intensity, and light intensity via the usage of Wi-Fi. All of the aforementioned factors are automatically detected by the study for the owner, which makes it feasible that the owner to steer clear of accidents and other undesirable circumstances when they are behind the wheel. Using an Internet of Things (IoT)-based smart tracking system for automobiles, another research design was developed. Framework for monitoring temperature and humidity that is based on the Internet of Things. Using a straightforward monitoring system, this research investigated the application of the Internet of Things, or IoT, for the purpose of monitoring the humidity and temperature of a data centre in real time. The aims of this investigation were to ascertain the connection and distinction between temperature and humidity in relation to the various locations where measurements were taken.

3. Methodology:

Automobiles have always been a means by which people are able to travel about in a quick and simple manner, and their usage has always been an activity that is part of daily life. This study has found a component of the problem that is caused by a variety of factors, including but not limited to changes in the climate, malfunctions in certain components of the vehicle, and weather-related changes. Therefore, in order to accomplish the objectives and goals of the system that has been provided, it is necessary to implement a certain methodology that has the potential to result in the desired process. After conducting an analysis of the various methodological approaches, the research team decided to use the Object-oriented analysis and design methodology (OOADM) for the research. This methodology was chosen because it has the capability to provide an object-oriented conception of both the proposed system and the existing system. Additionally, it enables the researcher to model the various functions of the users on the platform by utilising the use case diagram. The OOADM stages include Object-Oriented Analysis, Object-Oriented Design, and Object-Oriented Implementation.

3.1. Studying the System:

In the process of system analysis, the current state of the issue is dissected into its component parts in order to conduct a thorough investigation.

3.1.1. Examination of the Present System:

The temperature system gauge of the car is included into the proposed systems, which also provide additional characteristics that the old system lacks the capacity to cover. On account of this, the current temperature gauge does not provide notice in the form of a beep alarm, which will not only be of assistance to old people. The driver is not only unable to see the temperature gauge on the dashboard, but it also draws the focus of the driver since there is a propensity for that he or she will not be paying attention to the situation. The currently available systems only

provide an analogue system on the dashboard of the car, which is unable to attract the attention of the person who is operating the vehicle.

3.1.2. Look at the Suggested System:

In the examination of the new system, the functioning of the additional features that have been added to the monitoring system is discussed. These features are contributing to an improvement in the temperature monitoring system. It is possible that the new system will make it possible for people who drive vehicles to be aware of an increase in temperature when the temperature rise contributes to the overheating of the car, which may finally result in significant damage to the vehicle. Furthermore, the new system has the capability to save information for use at a later time. The following is an analysis of the suggested monitoring system, which may be seen in figure 2 below:

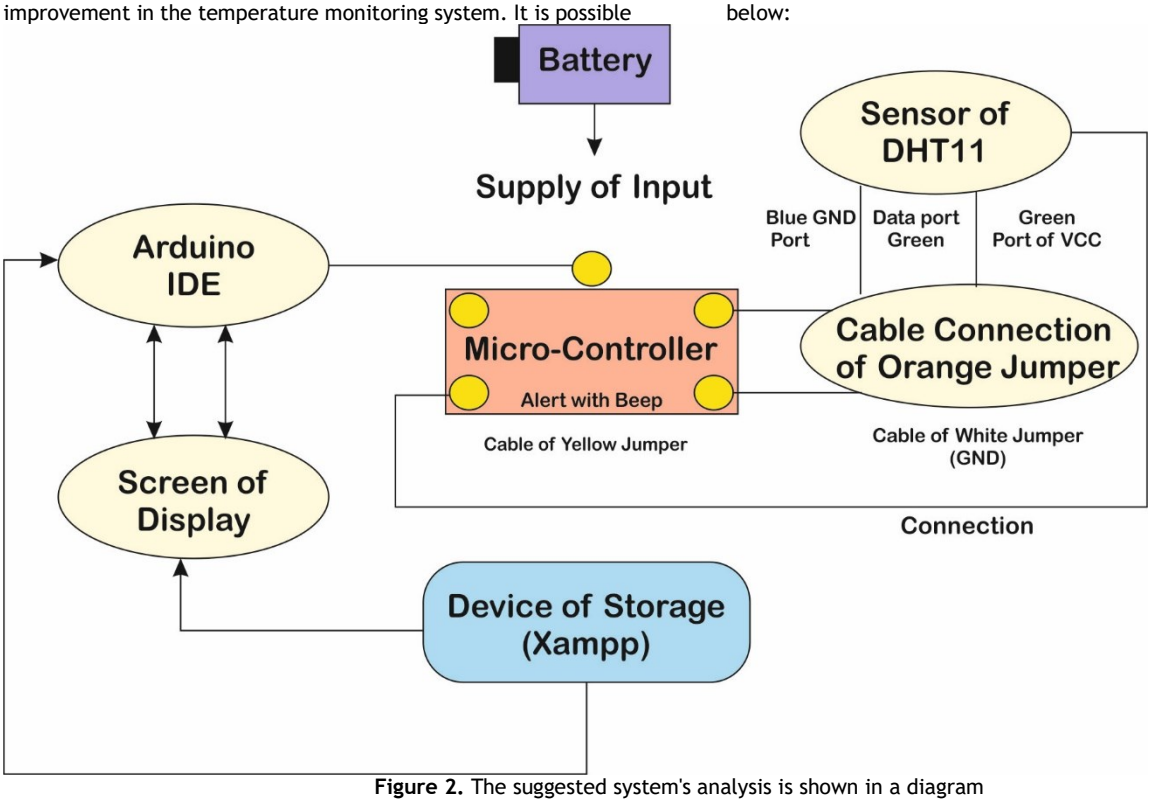

Figure 2. The suggested system's analysis is shown in a diagram

A board called a UNO version of the Arduino Micro Controller is used in the suggested system. This board is responsible for controlling the functions of the suggested system's components. The ADHT11 sensor is attached to the controller, and it is this sensor that is accountable for dictating variations in temperature. A signal will be sent back from the DHT11 to the micro control via the data lines if it is determined that there has been an increase in temperature. This signal will cause the micro controller to begin beeping. The buzzing is done using a beep buzzer, and the database is then updated with the current temperature status. The power behind the system comes from the power system of the car. Figure 3 shows the study of the current setup.

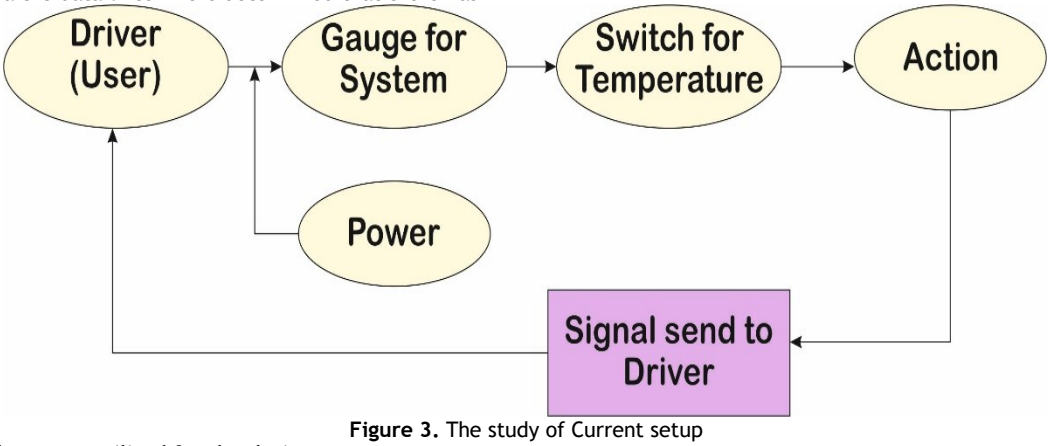

Figure 3. The study of Current setup

3.1.3. Things that were utilised for the design:

For the purpose of developing the temperature alarm system, the elements that are specified in Figure 4 listed below are used.

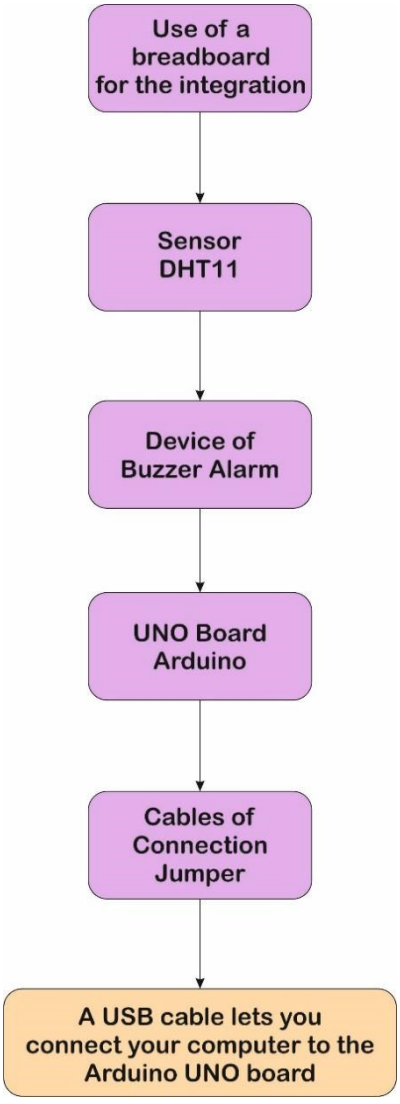

Figure 4. Things needed to build the suggested system

CONCLUSION

As was said previously, the development of an Internet of Things (IoT) base system that is capable of detecting and monitoring overheating in automobiles via the use of temperature alarm architecture is the objective of this study. A straightforward design that was able to create a smart alarm approach that will enable both young people and senior people have a clearer sound and signal of the temperature of the car and trigger appropriate action is shown here. For this reason, the findings of this research suggest that vehicle manufacturers and firms, both domestic and foreign, should include the design into their future production, if it is not currently in place but should be considered in the future and implemented.

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