Template -VI

Patent Idea Submission

CONTACTLESS TEMPERATURE DETECTOR

Revision	Date	Rev by	Change Description
1.0	27-05-2023		initial template revision - replace this with your invention revision information

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Summary of the invention

• Brief description of the invention

1) To design and implement an automatic contactless temperature detector which is in-built in a system (Gate).

2) The selection of components for a contactless temperature detection system involved a systematic procedure to ensure compatibility, functionality, and reliability. First we defined System Requirements: By defining the requirements of temperature detection system. Considering factors such as the measurement range, accuracy, response time, power consumption, interface compatibility, and any specific features or functionalities required.

3) Research and Identify Suitable Components: Conduct thorough research to identify components. Arduino UNO, MLX90614 infrared sensor based module, LCD display with I2C module and Arduino Buzzer.

4) Checking Component Compatibility: Verifying the compatibility of the selected components with each other and the chosen microcontroller (in this case, Arduino). Checking the technical specifications and documentation of each component to ensure they can communicate and function together effectively. Paying attention to factors such as communication protocols, voltage levels, pin requirements, and libraries or drivers available for integration.

5) Considering Application-Specific Requirements: Evaluating whether the selected components meet any specific requirements related to project. In this case, the components detect the temperature in contactless manner and are compatible with the system.

6) Evaluating Cost and Availability: Considering the cost and availability of the components.

7) Reading User Reviews and Documentation: Looking for user reviews, datasheets, and application notes for the selected components.

8) Finalizing Component Selection: Based on the evaluation and testing, make the final component selection.

9) Enclosing the system in cabinet and attaching it to the gate for detection of temperature.

•Definitions, Terms, Elements

1. Arduino is an open-source electronics platform. It consists of both hardware and software components. Arduino boards are microcontroller-based development boards. Arduino boards can be programmed to perform various tasks.They have input and output pins and power supply options.

2. The Arduino IDE is the programming environment used to write and upload code.It provides a simplified programming language based on C/C++.Arduino boards are used for creating interactive projects and prototypes.

3. An LCD display with an I2C module is a type of liquid crystal display (LCD) that incorporates an I2C (Inter-Integrated Circuit) module for communication.The I2C module allows for easy interfacing of the LCD display with other devices, such as microcontrollers or computers, using the I2C protocol.It simplifies the wiring and reduces the number of pins required for communication compared to traditional parallel interfacing methods.The LCD display with I2C module typically consists of a display panel, backlight, and an I2C communication module.It can display alphanumeric characters, symbols, and even graphical elements.The I2C module allows for control of the LCD display, such as setting the cursor position, displaying text, and controlling the backlight.The LCD display with I2C module is widely used in embedded systems and projects where simplicity and ease of integration are desired.

4. MLX90614 is an infrared temperature sensor.It allows contactless temperature measurement.It uses a thermopile to detect infrared radiation emitted by objects.The sensor has an integrated signal conditioning ASIC.It is housed in a small package with an optical filter to eliminate ambient light interference.MLX90614 offers two measurement modes: object temperature (TO) and ambient temperature (TA).It typically communicates with microcontrollers or computers using the I2C protocol.Calibration is necessary for accurate temperature measurements.MLX90614 is used in various applications, including industrial temperature monitoring, medical devices, home automation, and automotive systems.It can be integrated with machine learning algorithms for advanced temperature detection and analysis.

5. A temperature sensor measures and detects temperature variations in its surroundings. It converts temperature into an electrical signal for measurement or interpretation. Temperature sensors are used in various industries, scientific research, and consumer applications. They are crucial for monitoring and controlling temperature in systems for optimal performance and safety. Temperature sensors utilize different principles such as resistance, voltage, thermocouples, infrared radiation, or semiconductor properties. Examples of temperature sensors include thermistors, thermocouples, RTDs, and digital temperature sensors. Temperature sensors are used in climate control systems, industrial processes, medical devices, automotive systems, and weather monitoring.

6. An infrared sensor is a device that detects and measures infrared radiation in its surroundings. It operates based on the principle that objects emit and reflect infrared radiation according to their temperature. Infrared sensors can be categorized into two types: passive and active. Passive infrared sensors detect the infrared radiation emitted by objects without emitting any signals themselves. Active infrared sensors emit their own infrared signals and measure the reflection or interruption of those signals to detect objects or motion. Infrared sensors are commonly used in applications such as motion detection, proximity sensing, temperature measurement, and remote control systems. They are widely used in security systems, automatic doors, occupancy detection, thermal imaging cameras, and remote control devices.

7. A jumper wire is a short length of insulated wire used to create electrical connections between electronic components on a breadboard, circuit board, or prototype. Jumper wires are typically made of flexible stranded wire, which allows for easy bending and insertion into various components.They come in different colors, such as red, black, yellow, green, and blue, to help differentiate between connections. Jumper wires have connectors at each end, which can be male pins, female sockets, or a combination of both. They are commonly used to establish temporary or permanent electrical connections between components without the need for soldering. Jumper wires facilitate the quick and easy prototyping and testing of circuits and electronic projects. They enable the transfer of signals, power, and ground connections between different parts of a circuit. Jumper wires are often used in conjunction with breadboards, where the wire's ends can be inserted into the board's contact points to create connections. They provide flexibility in rearranging and modifying circuits during the prototyping phase. Jumper wires are an essential tool for electronics hobbyists, students, and professionals working with breadboards or building and testing electronic circuits.

Background of the Invention (Prior Art)

- Patent Background

1) Title: Design of a Non-Contact Infrared Thermometer

Author: Guangli Long

Publication: International Journal on smart sensing and intelligent systems Vol-9

Publication Date: June 1, 2016

2) Title: A Novel Wearable Device for Continuous Temperature Monitoring & Fever Detection

Author Name: Nishant Verma

Publication: IEEE Journal of Translational Engineering in Health and Medicine

Year: 19th July 2021

3) Title: Application of Temperature Measurement Contactless with Bidirectional Visitor Counter Using IOT as a Covid 19 Protocol

Author: Wayan Agus Putra

Publication: Advances in Social Science , Education and Humanities Research

Publication Date: 2021

4) Title: Comparative accuracy testing of non-contact infrared thermometers

Author: Scott Adams PhD,Kelly Decker MN

Publication: School of Nursing & Midwifery,Deakin University,Geelong,Australia.

Publication Date: 2020-2021

• Publication Background

When conducting a publication background for a project involving non-contact temperature detection using the MLX90614 sensor with an I2C module, you would typically research existing publications, papers, articles, and related work in the field. Here are some key areas to explore:

Scientific literature: Search for scientific journals and publications related to infrared temperature sensing, non-contact temperature measurement, MLX90614 sensor applications, I2C communication, and similar topics. Look for papers that discuss principles, methodologies, experimental setups, calibration techniques, and validation methods for temperature measurement using similar sensors and techniques.

Conference proceedings: Explore conference proceedings in relevant fields such as engineering, electronics, instrumentation, or sensors. Conferences often showcase the latest research and developments in specific areas, including non-contact temperature measurement or thermal sensing. Look for papers or presentations that describe projects, experiments, or case studies involving MLX90614 or similar infrared temperature sensors.

Patents and patent applications: Review existing patents and patent applications related to non-contact temperature measurement, infrared sensors, or temperature sensing techniques. Patents can provide insights into prior art and reveal advancements, novel approaches, or specific applications related to the MLX90614 sensor or I2C integration for temperature detection.

Technical articles and application notes: Check technical articles and application notes published by manufacturers, suppliers, or distributors of the MLX90614 sensor or I2C modules. These resources often provide guidance, usage tips, example projects, and implementation details for integrating the sensor into various applications, including non-contact temperature detection.

Online resources and forums: Explore online platforms, forums, and communities dedicated to electronics, sensors, or temperature measurement. Look for discussions, projects, tutorials, or code examples related to non-contact temperature sensing with the MLX90614 sensor and I2C communication. Platforms like Arduino forums, electronics Stack Exchange, or specialized sensor communities can be valuable sources of information and insights.

By thoroughly researching and analyzing existing publications in these areas, you can gain a comprehensive understanding of the current state of the field, identify any knowledge gaps, and position your project within the existing body of knowledge. Remember to cite and reference the relevant publications appropriately when writing your own publication to acknowledge prior art and establish the context for your work.

- "Prior art known to those skilled in the art"

The "Prior art known to those skilled in the art" for a project involving temperature detection using the MLX90614 sensor with an I2C module would refer to existing knowledge, information, or technology that is publicly available to experts or professionals skilled in the relevant field.

In this case, the prior art may include:

Documentation and datasheets: The MLX90614 sensor is a widely used infrared thermometer sensor, and there are official documentation and datasheets available that describe its features, specifications, and usage. These documents would be considered prior art and are typically known to those skilled in the field.

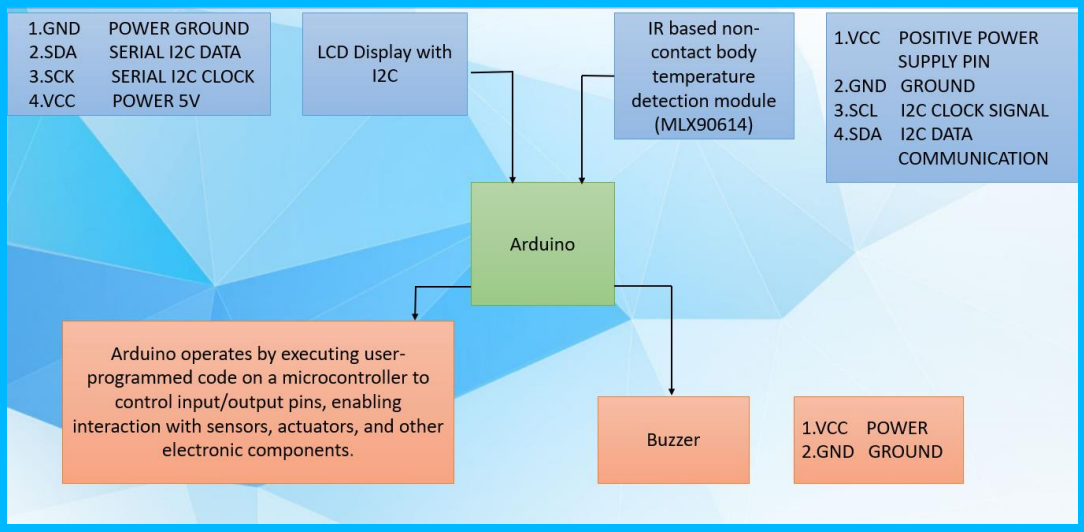
Application notes and reference designs: Manufacturers or developers of the MLX90614 sensor may provide application notes or reference designs that explain how to interface and use the sensor with different microcontrollers or communication protocols, including I2C. These resources are often available and accessible to those skilled in the art.

Online forums and communities: Skilled individuals in the field might discuss or share their experiences, projects, and code examples related to using the MLX90614 sensor with an I2C module on online platforms, such as forums, blogs, or GitHub repositories. These community-driven resources can serve as prior art and provide valuable insights and solutions.

Published research papers and articles: There might be scientific papers, technical articles, or research publications that discuss the MLX90614 sensor's capabilities, limitations, and potential applications in temperature detection or related fields. Researchers and academics in the field often contribute to the body of prior art.

It's important to note that the specific prior art known to those skilled in the art can vary over time as new information becomes available. To determine the precise prior art for a particular project, a thorough search and analysis of the existing literature, resources, and expertise in the relevant field would be necessary.

Detailed Description of the Invention



- Drawing Figures

Provide an overall view which provides context, as well as a detailed set of drawings of the important elements from the overall view. Show the invention including the relationship between the elements and any required interconnections The drawings themselves can merely be informal sketches, and you can fax them to us at 650-494-3835 if you don't have them available in an electronic format.

- Alternate Embodiments

Alternate embodiments for a project involving non-contact temperature detection using the MLX90614 sensor with an I2C module can involve variations in design, implementation, or additional features. Here are a few possible alternate embodiments:

Different temperature sensor: Instead of using the MLX90614 sensor, an alternate embodiment could employ a different non-contact temperature sensor, such as the MLX90615, MLX90621, or an entirely different sensor technology like a pyroelectric sensor or an infrared camera module. Each sensor may have its own characteristics, resolution, sensing range, or additional features that can be explored based on the specific requirements of the project.

Wireless communication: While the project initially uses the I2C communication protocol to interface with the MLX90614 sensor, an alternate embodiment could incorporate wireless communication methods, such as Bluetooth, Wi-Fi, or LoRa, to

transmit temperature data. This can enable remote monitoring or integration with other devices or systems without the need for physical connections.

Multi-sensor array: Instead of using a single MLX90614 sensor, an alternate embodiment could employ an array of sensors arranged in a matrix configuration. This allows for simultaneous temperature measurements at multiple points or the ability to capture temperature distributions. The data from the sensor array can be processed and analyzed to extract additional information or provide a more comprehensive view of the temperature profile.

Advanced data processing and analysis: An alternate embodiment can focus on advanced data processing and analysis techniques to extract more information from the temperature measurements. This could involve applying machine learning algorithms, statistical analysis, or image processing techniques to enhance the accuracy, identify patterns, or detect anomalies in the temperature data.

Integrated display or user interface: An alternate embodiment may include an integrated display or user interface to provide real-time temperature readings or visualizations. This can involve incorporating an LCD screen, LED indicators, or even integrating with a mobile app or web-based interface for convenient temperature monitoring and control.

Power-saving modes or energy harvesting: An alternate embodiment can focus on power-saving features or energy harvesting techniques to optimize the power consumption of the system. This can include sleep modes, power management algorithms, or integrating energy harvesting mechanisms like solar panels or thermoelectric generators to prolong the device's operational life or enable autonomous operation.

Integrated microcontroller: In the original block diagram, there may be a separate microcontroller responsible for processing and controlling the temperature measurement. An alternate embodiment could feature an integrated microcontroller within the MLX90614 sensor module itself. This would consolidate the processing capabilities and reduce the need for external microcontrollers, simplifying the overall system design. Data logging and storage: An alternate embodiment might include a dedicated block for data logging and storage. This block would allow the system to store temperature measurements locally, either on an integrated memory chip or an external storage medium such as an SD card. This feature would be useful for applications requiring historical data analysis or offline operation. Real-time visualization: An alternate embodiment could include a dedicated block for real-time visualization of temperature data. This block would provide visual representations such as graphs or heatmaps, allowing users to monitor temperature changes in real-time. Integration with a display or communication interface would be required to present the visual output.

Power management and optimization: An alternate embodiment might introduce a dedicated block for power management and optimization. This block would incorporate power-saving techniques such as sleep modes, dynamic power management, or intelligent power allocation strategies to maximize the system's energy efficiency and extend battery life in portable applications. Calibration and self-diagnosis: An alternate embodiment could include a calibration and self-diagnosis block. This block would enable the system to periodically calibrate the sensor, compensate for any drift or deviations, and perform self-diagnostics to ensure accurate and reliable temperature measurements. This feature would enhance the system's long-term stability and reduce the need for manual calibration.

- ## Advantages of the Invention compared to Prior Art

When comparing the advantages of an invention for a project involving non-contact temperature detection using the MLX90614 sensor with an I2C module to the prior art, several potential advantages could be considered. Here are some possible advantages:

Accuracy and Precision: The invention may offer improved accuracy and precision in temperature measurement compared to prior art. It could incorporate advanced algorithms, calibration techniques, or signal processing methods to enhance the accuracy of temperature readings, minimizing errors and deviations.

Sensing Range: The invention might expand the sensing range of the MLX90614 sensor beyond what is achieved in prior art. It could provide reliable temperature measurements over a wider range, allowing for detection of higher or lower temperatures with improved sensitivity and resolution.

Speed and Responsiveness: The invention could exhibit faster response times, enabling real-time temperature monitoring and rapid detection of temperature changes. It might optimize the communication protocol or implement efficient algorithms to minimize latency, resulting in quicker temperature measurements.

Integration and Compatibility: The invention may offer enhanced integration capabilities with different microcontrollers, platforms, or systems. It could provide a seamless integration with I2C modules, facilitating easier setup and utilization in various applications. Additionally, it could ensure compatibility with existing software libraries or frameworks, simplifying development and reducing implementation effort.

Power Efficiency: The invention might introduce power-saving features or optimized energy consumption strategies. It could utilize low-power modes, sleep states, or intelligent power management techniques to prolong the operational life of the sensor and associated systems, making it more suitable for battery-powered or energy-conscious applications.

User-Friendly Interface: The invention could include a user-friendly interface or display options, allowing users to easily interact with and interpret temperature measurements. It might provide intuitive controls, graphical representations, or configurable settings to enhance usability and accessibility.

Cost-Effectiveness: The invention might reduce overall system costs compared to prior art by utilizing cost-efficient components, streamlining manufacturing processes, or optimizing resource utilization. It could provide a more affordable solution without compromising performance or quality.

It is important to note that the advantages of the invention would need to be supported by evidence, experimental results, or comparative studies to demonstrate its superiority over the prior art. Proper documentation, testing, and validation would be necessary to establish and substantiate these advantages.

- Mathematical Derivations

To derive the mathematical relationship between voltage and temperature, we need to consider specific properties of the sensor or system under consideration. Without additional information about the sensor or circuitry involved, it is challenging to provide a specific derivation. However, I can explain a general approach for temperature-voltage relationships based on some common principles.

Temperature-dependent resistance (RTD, thermistor, or semiconductor):

Many temperature sensors, such as resistive temperature detectors (RTDs), thermistors, or certain semiconductor-based sensors, exhibit a change in resistance with temperature. In this case, Ohm's Law can be applied to establish a relationship between resistance and voltage.

Let R(T) represent the resistance as a function of temperature T, and V be the voltage across the sensor or circuit. Assuming a simple circuit where the sensor is connected in series with a fixed resistor R0 and a voltage source, the voltage across the sensor can be expressed using Ohm's Law:

$V = I * (R(T) + R0)$,

where I is the current flowing through the circuit. By solving for V, we can obtain the relationship between voltage and temperature based on the temperature-dependent resistance.

Voltage output from a sensor with a known transfer function:

Some temperature sensors provide a specific transfer function that relates temperature to the output voltage directly. These transfer functions can be derived from calibration data or determined through characterization of the sensor. In this case, the mathematical relationship between voltage and temperature is already defined, and no further derivation is required.

Inventor and Public Use Information

- Title of the Invention

CONTACTLESS TEMPERATURE DETECTOR

- Inventor Information

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- Invention Dates

1) Date of original conception of patent idea:

20 Sep 2022

2) Date reduced to practice (if completed, estimated reduction date if not completed).

7 Oct 2022

3) On-sale Date: date the invention went (will go) into a product offered for sale.

We are planning to complete our project till May 2024.

4) Estimated first public use :June,2024