Design and Development of Arduino Based Contactless Thermometer

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Abstract— In present situations, social distancing is the most important fact. Furthermore, the fact is COVID-19 patient's first symptom is body temperature is high. The reason why, measuring body temperature is most important, but needs to maintain social distancing. While traditional thermometers can't make sure of social distancing, where our developed contactless thermometer can achieve temperature on display by using Arduino unoR3 as the main control device as well as MLX90614 as the infrared (IR) thermometer sensor. As a result, compared with the traditional thermometer, it shows strong points such as convenient reading, wide range of temperature measurement, and accuracy where temperature output is displayed digitally. Besides, it would be used everywhere because of its easy-handling.

Keywords— IR, Thermometer, Arduino, UNO Contactless thermometer, MLX90614.

I. INTRODUCTION

In recent times, World is going towards a bad situation due to the Coronavirus disease (COVID-19). Where most of the country in hugely are suffering from this disease as well as everyone is endangered for unseen viruses. An infrared thermometer is a thermometer which infers temperature from a portion of the thermal radiation sometimes called black-body radiation emitted by the object being measured. They are sometimes called laser thermometers as a laser is used to help aim the thermometer, or non-contact thermometers or temperature guns, to describe the device's ability to measure temperature from a distance. Infrared thermometers can be used to serve a wide variety of temperature monitoring functions. A few examples provided include checking mechanical or electrical equipment for temperature and hot spots, measuring the temperature of patients in a hospital without touching them, checking heater or oven temperature, for calibration and control, checking for hot spots in fire-fighting, monitoring materials in processes involving heating or cooling [1]. A traditional thermometer which is now being developed and used for measuring body temperature from objects is high risk for all because of keeping nearly touch that is not long distance from the affected people. In that case, contactless thermometers can be used everywhere such as normal places or risky places. For example, to measure hot bodies temperature in industries and research laboratories. Furthermore, in the medical field, where a badly infected/burned patient's body temperature measurement is unsafe and insecure. In this place a contactless thermometer is much helpful. It is easy, safe and accurate to measure temperature. In this paper we describe the principle of making contactless thermometers. In this system, an Arduino UNO, MLX90614 temperature sensor, OLED Display and battery as power source are included for providing the developed system. In our thermometer wide -70 to 380˚C range temperature measurement with accuracy of 0.5˚C [1]. The digital display system for the output of the temperature is simple and economic, operation reliable and environmental friendly.

This paper is organized as follows: Firstly, section II explains the design principles. Secondly, section III describes Flowchart, Block Diagram and Circuit Design. Thirdly, Section IV, discuss the Result and Output of the developed system. Eventually conclusion is drawn in section V.

II. DESIGN PRINCIPLES

The traditional thermometer is used to body contact for measuring temperature. On the other hand our thermometer does not need any contact to measure temperature. MLX90614 temperature sensor and OLED display are connected to Arduino UNO [2]. The two components are connected to an analog pin of the Arduino UNO [3]. When the

desired body or object is in the range of the thermometer then MLX90614 reads the temperature and shows it on display. There is a led/IR light for accurate target for measuring temperature of objects. When the switch is on, the Arduino gets power and the MLX90614 reads temperature. The IR-thermometer MLX90614 having access by 2 wire serial SMBus compatible protocol (0.02°C resolution) or via 10-bit PWM (Pulse Width Modulated) output of the device is used [4-6]. The measured temperature can be read directly and easily, and then be converted to meet the design requirements. The Flowchart, block diagram and circuit diagram is shown in figure-1, figure-2 and figure-3 respectively. Which describes the detailed design of the system along with various components present in it.

III. FLOWCHART, BLOCK DIAGRAM AND CIRCUIT DESIGN

Flowchart- The flowchart of the developed system is shown in Fig. 1. To begin with the pressing power switch, the Arduino becomes on and temperature sensor on too, Following this, the temperature sensor reads object or body temperature and shows the result on display. Firstly, the system initializes analog pins A4 and A5 as well as initializes OLED power. If the power switch is held on, the system continuously reads and provides the temperature. Otherwise, it will delay some time and end the loop. In addition, if the power switch is pressed, the loop repeats the same process.

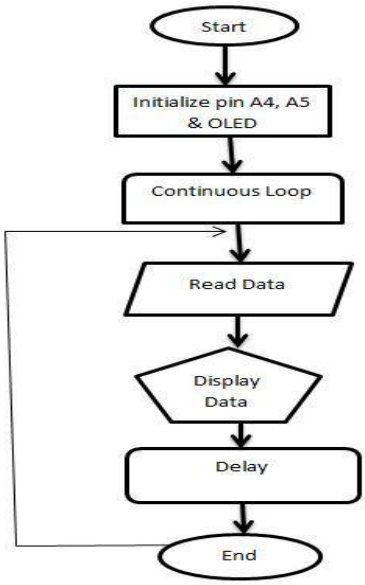

Fig. 1: Flow Chart for the developed system

Block Diagram- The block diagram is shown in Fig. 2 where it depicts all the equipment which are connected to each other. Firstly, the MLX90614 temperature sensor reads data from body or object. Secondly, the received data is sent to Arduino for further processing and after performing the operations, the system displays the results.

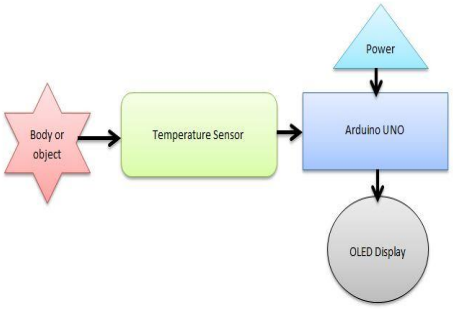

Fig. 2: Block Diagram

Circuit Diagram- The circuit diagram is depicted in Fig. 3 with showing the circuit design of the system. In where, MLX90614 temperature sensor and even OLED display are connected with Arduino analog pin-4 and pin-5. At the same time, MLX90614 temperature sensor SCL is also connected with clock pic and SDA is with data pin simultaneously. To some extent, MLX90614 Infra-Red thermometer is a four pin, SMBus based device produced by Melexis Company [7-8]. It possesses characteristics including simple circuit, smaller size, wider applications and more economical. The on-site temperature is transmitted directly by "bus line" digital mode, which greatly enhances the anti-jamming system. It's suitable for on-site temperature measurement in harsh environments such as: environmental control, equipment or process control, electronic consumables which need proximity type temperature measurement. Fig. 3 represents the MLX90614 Schematic and picture which helps the circuit understanding.

The main features for MLX90614:

- Only two ports were needed to achieve Communication.
- Each component of the DS18B20 has a unique serial number.
- Realize temperature measurement without external components.
- Measuring temperature range between –70 to 380 °C for object temperature
- Digital IR thermometer Measurement resolution of 0.02°

- Having Power saving mode, low noise amplifier, high resolution 17-bit ADC and powerful DSP unit of MLX90302.

OLED displays are also known as organic light-emitting diodes. Here we used a 0.96inch OLED display.

Features of OLED display:

- OLED Driver IC: SSD1306
- Resolution: 128 x 64
- Visual Angle: >160°
- Input Voltage: 3.3V ~ 6V
- Compatible I/O Level: 3.3V, 5V
- Mini Size: 2.7 x 2.8cm
- Only Need 2 I/O Port to Control.

The Arduino Uno R3 is a microcontroller board based on the ATmega328. It has 16 MHz crystal oscillator, 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a power jack, a USB connection, an ICSP header, and a reset button. It simply connects it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Main features:

- Operating Voltage: 5V
- Microcontroller: ATmega328
- Input Voltage (recommended): 7-12V
- Clock Speed: 16MHz

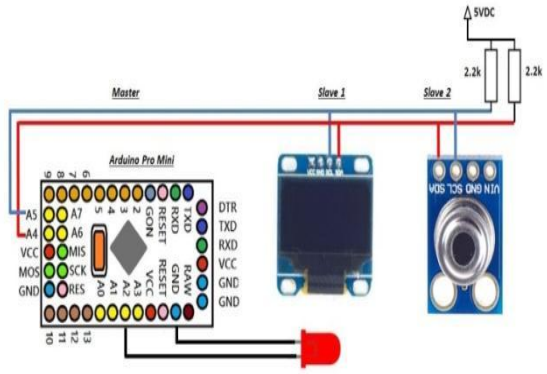

Fig. 3: Circuit Diagram

IV. RESULT AND OUTPUT

After completing our project it is the output. Here we can see the desired contactless thermometer which is used for measuring temperature without any contact. Fig. 4 is shown in room temperature. In this system we make a target for measuring temperature which would be someone's body or object. Moreover, the temperature will show in the OLED display. Fig. 5 is also shown the front view of the thermometer. Here we can see MLX90614 temperature sensor and a led/IR light for accurate target of desired object or body. Besides, the last Fig. 6 is provided with the side view of the contactless thermometer. At this time, the system considers a switch where if the switch is pushed down the Arduino gets power and the MLX90614 sensor reads temperature.

Fig. 4: Showing Room temperature

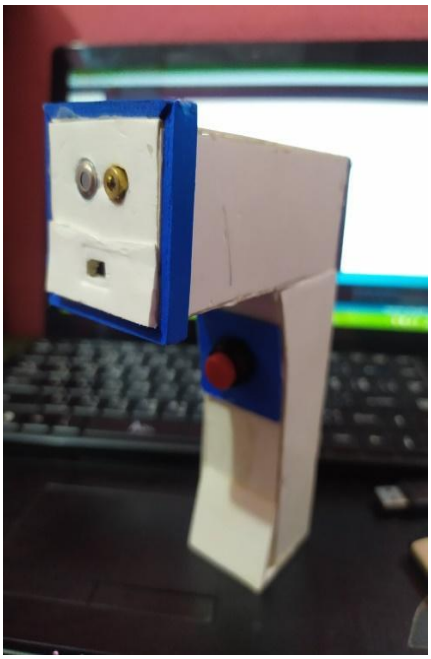

Fig. 5: Front view of contactless thermometer

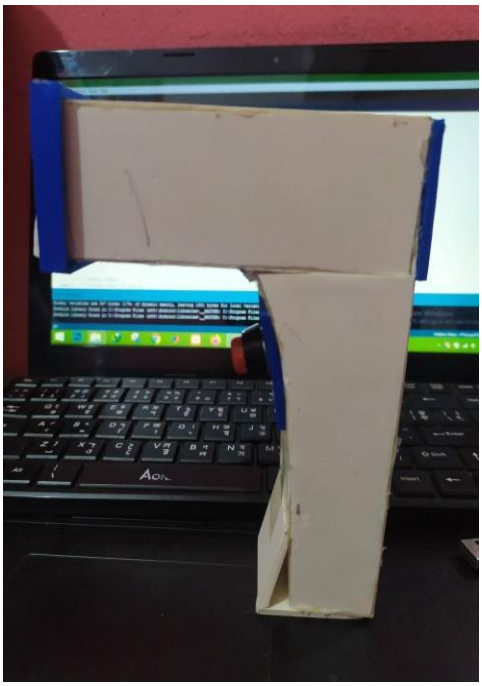

Fig. 6: Side view of contactless thermometer

V. CONCLUSIONS

The system depicts the development of a contactless thermometer. Where we are fighting against unseen viruses which increase day by day contacting by person to person. So we need to maintain social distancing and need to measure body temperature without any contact. This system will help for making any contactless thermometer and measuring temperature without contact. In addition, the contactless thermometer is more advantageous in the application especially in the medical field. The system is successfully implemented and evaluated using highly advanced ICs and with the help of growing technology.

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