

MITIGATING RISK THROUGH AUTOMATIC TEMPERATURE SENSING

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Abstract - The pandemic has increased in the global countries due to the Covid-19. The major symptom of Covid-19 is fever, sore throat, and loss of taste. During this instance, the temperature measurement is the most important role that can help to detect the risk of Covid-19. Automatic Temperature Sensing is the most significant tool that can be developed through the Internet of Things and Arduino Uno to measure and sense the temperature of people. In this research paper, the development process of ATS and the importance of ATS in the Covid-19 risk mitigation process have been discussed briefly. This research aims to detect the importance of ATS in Covid-19 pandemic risk management. In addition to that, the research has some objectives and those are detecting issues of pandemic and mitigating risks through using ATS in shopping malls, supermarkets, and movie theatres. The research has also discussed the importance and contribution of IoT in the ATS development process and the role of Arduino Uno in the temperature sensing process. This research can be helpful for other researchers and scholars to increase their knowledge of ATS.

Key Words: Internet of Things, Arduino Uno, ATS, Noncontact temperature Measurement System, Covid 19, MLX90614.

1. INTRODUCTION

Covid-19 is the major issue in the world and it has increased more health issues in people globally. In this case, this pandemic situation has impacted the economy and reduced the GDP growth rate of all countries. On the other hand, Covid-19 has a symptom of fever and in a population, fever is needed to check to mitigate the risk of spread of Covid-19 in a phenomenon. In this case, the importance of temperature sensing has increased and it is used to sense the temperature of people to check fever. This research aims to analyse the importance of Automatic Temperature Sensing (ATS) in mitigating the risk of Covid-19. The current scenario of pandemic refers that this deadly virus may never leave and to manage this situation forever, the ATS is important. Contactless temperature sensing can help people to check the temperature and mitigate the spread of Covid-19 in a population. It can increase the security of a population and reduce the cost of the country. The objective of this research is to detect, emphasize, and analyse the impact of ATS in Covid-19 risk mitigation. The ATS can be used in any place such as shopping malls, movie theatres, and supermarkets.

2. Literature Review

2.1 Impact of Covid-19

The pandemic has an impact on the health of people and the death rate due to Covid-19 has increased globally. In addition to that, it has a positive impact on the environment to reduce global warming. On the other hand, Covid-19 harms the economic development process and the economy of the global countries has decreased. Apart from that, it is the cause of the development of the Non-Contact Temperature Measurement System [1]. High fever is the symptom of this virus and it is needed to measure the temperature of people in a gathered population. This pandemic has increased the issues in health and economy similarly. The businesses of India and other countries have faced major issues in the supply chain management process. Due to this case, in India, the ATS has been developed to check temperature to mitigate the risk of the Covid-19 pandemic.

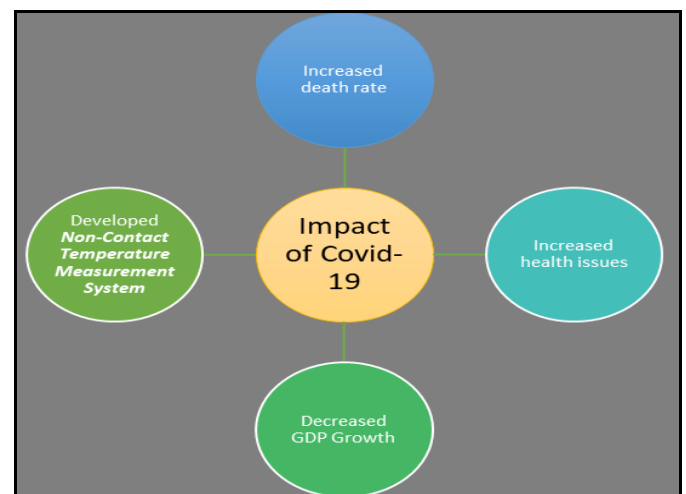


Figure 1: Impact of Covid-19 [1]

2.2 Concept of Automatic Temperature Sensing

Automatic temperature sensing is used to sense the temperature of people to check the fever of people in a population. Due to the Covid-19 impact, this tool is developed in India to sense the temperature of people. In addition to that, through the Internet of Technology, this tool has been made. Using an IoT device, this tool of temperature sensing has been created. In this case, High-tech Arduino is used to measuring the temperature of people and check covid-19 in people. This modern gadget is used in the doors of shopping malls, supermarkets,

movie theatres, and other areas [2]. Arduino Uno is the hardware that is used to find out people who are facing the issue of fever and this hardware helps to detect temperature. Detecting and controlling temperature is most important globally to manage pandemic situations. Hardware implementation is important to manage automation in the temperature sensing process. IoT helps to sense the temperature automatically of people in a population.

2.3 Role of ATS in Risk Mitigation

The role of ATS is important during the pandemic and mitigates the risk of the pandemic in global countries. Needless to say, the pandemic is increasing in the world with various kinds of variants. Omicron is another variant that is found in India and other countries and the main symptom of all variants is high fever. Due to this case, gatherings have to be avoided and in a gathered population, temperature sensing is useful. In this case, the most important role of this tool is to detect temperature automatically without any contact with people [3]. In addition to that, it helps to begin the treatment process and mitigate the risk of the spread of the coronavirus in a phenomenon. Advanced thermometers help in the social distance process and reduce physical interaction between people.

3. Material and Methodology

This research has focused on the development process of ATS and the design of ATS is conducted in this research. Through improving the design of IoT, the temperature sensing process can be developed and in this case, the Arduino Uno can be used. In the first movement, the systems' direct, inspiration, and essentials (such as data examination necessities, data grouping requirements, data insurance, structure the chief's requirement, security necessities, UI necessities, and others) are trapped. In the second stage, the connection-specific of the IoT plan approach is demonstrated. The third step of designing is to elaborate the domain model of the IoT plan approach. The fourth step of IoT designing is to emphasise the information model. An information model is the plan of all information in the IoT system, for instance, Virtual Entity credits, relation, and others [4].

In the fifth step of the IoT plan approach, organisation judgment is portrayed. It includes organisation types,

endpoints, inputs, schedules, effects, and preconditions. The sixth level of this process is to depict the structure of the IoT level. The seventh step of this designing process is to depict the functional view in the IoT plan Framework. Each functional group provides either information about thoughts or functionalities for partners with events of thoughts emphasised in the Area Model [5]. The eighth step of this research method is to depict the significance of the Operational view specifications in the IoT plan framework. Besides that, this movement depicts different decisions for IoT systems sending and action such as accumulating decisions, organisation and application working with decisions, contraption decisions, and others. In the IoT plan strategy, the coordination of parts and devices is the final step.

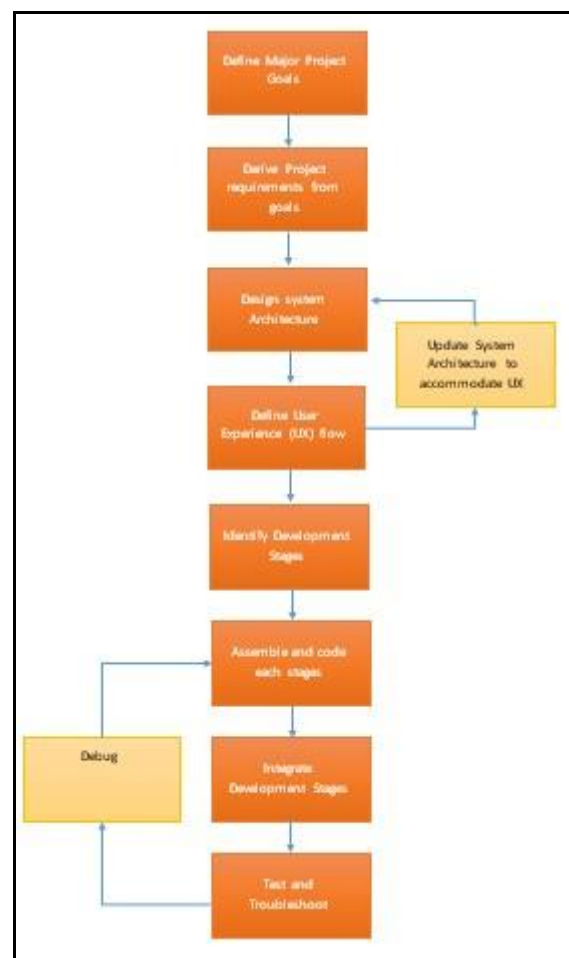


Figure 2: IoT design Methodology [4, 5]

4. Results and Discussion

In the IoT plan strategy, it is needed to provide maximum accuracy and availability. In addition to that, through managing the implementation process, maintainability, reliability, and ease of use can be developed. Apart from that, it can provide visualised analysis in the IoT process to sense the temperature properly and check the temperature in real-time.

4.1 Analysis and Design

4.1.1 Use Case Diagram

Case charts help to address the general scenario of the IoT framework. This situation is the steps of a succession that is depicting a collaboration between a framework and a client. Therefore, utilisation case in the designing process is a bunch of scenarios integrated through some objective [6]. The case outlines are drawn to uncover the activities of the framework.

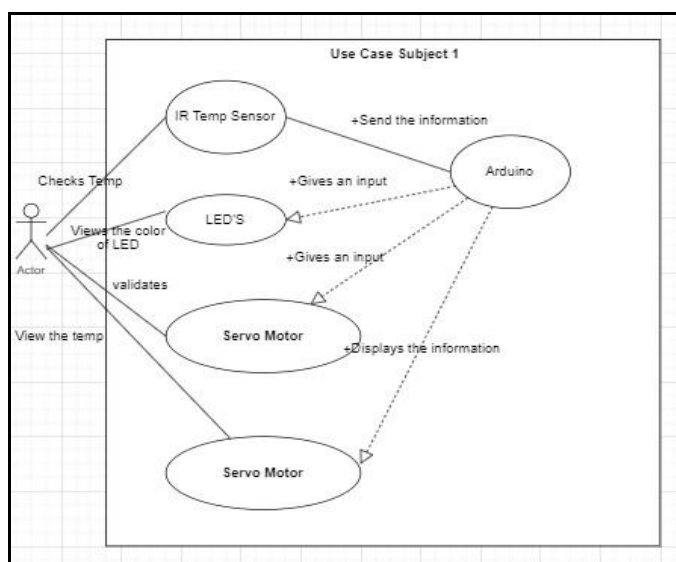


Figure 3: UseCase Diagram [6]

4.1.2 Activity Diagram

An activity diagram is a graphical representation or flowchart that portrays workflows of activities stepwise [7]. In this case, it is used to portray the progression of communication inside direct scenarios.

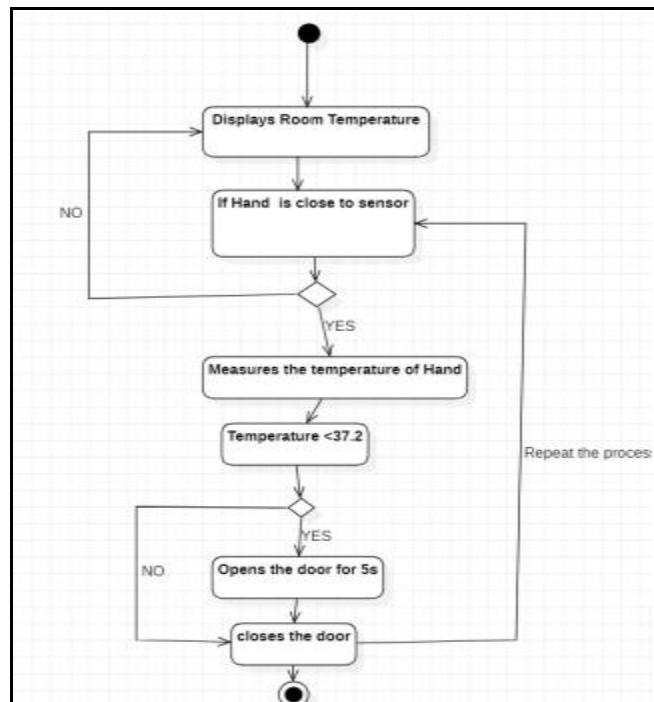


Figure 4: Activity Diagram [7]

4.1.3 Class Diagram

The class diagram in the UML (UnifiedModelling Language) is a type of static construction graph that portrays the design of a structure or framework by depicting the classes of the framework, its qualities, techniques, or activities, and the relations among objects [8]. In this diagram, activities of hardware, software, and plan framework are depicted properly.

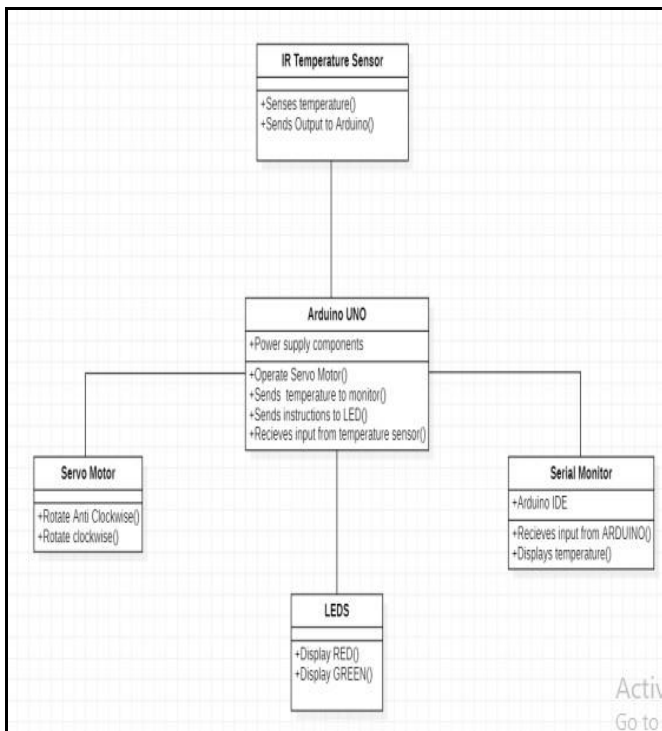


Figure 5: Class Diagram [8]

4.1.4 Sequence Diagram

A sequence diagram helps to depict the details of a framework such as activities, planning, time sequence, and techniques of a program. It is an interaction diagram that depicts object interactions in a specific situation [9]. In this case, it depicts the interaction between MLX90614 (IR Temp Sensor), Servo Motor, Arduino Uno, LED'S, and Serial Monitor.

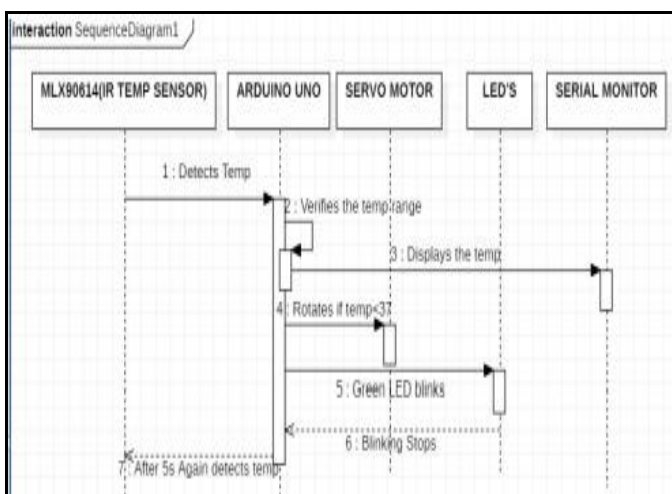


Figure 6: Sequence Diagram [9]

4.2 Result

4.2.1 Implementation Details

In this case, it can be stated that people come near to the sensor and the sensor senses the temperature of people. From a particular distance, the sensor can sense the temperature of people through implementing some coding, hardware, and software [11]. In the IoT system, the numbers are coded to get a vision of the temperature of people. The sensor senses temperature if the temperature of people is normal (37 degrees centigrade) or more than normal. Arduino has a major role in this system design and sensing management process. The system is designed to automatically open and close the doors of any shopping mall, supermarket, and movie theatre. In the sensor, if the temperature sensor has sensed that the temperature of any people is higher than normal then the red light will be blinking and the door will not open.

In this technique, the breadboard is used to manage connections that are required by the sensor and motor both from the ground of the sensor. In addition to that, type-A and type-B wires are used in this sensor to connect the hardware with Arduino to support its program. In this program of IoT framework planning, the Arduino IDE is used to run the code of motor, sensor, and LEDs together. Along with that, the cable and Arduino library are used to manage the connection between software and hardware components and to support the program properly. Therefore, in this process, the serial monitor is perceived to know the temperature of a room and it also helps to detect and sense the temperature of people's hands. As per the research, it can be stated that the MLX90614 Temperature Sensor is helpful to sense the temperature of people without any contact [12]. Except, the MG90S Servo motor helps to get signals of high temperature and it manages the red blinking process in IoT design.

The temperature sensor can sense the temperature of people and gives input to the Arduino. Therefore, Arduino takes the information and provides the input to the servo motor to control the instruction of the door. In this case, the importance of the Arduino is to manage the sensor to allow people to enter any place and the Arduino validates the temperature of people [13]. In addition to that, it can be stated that servo motors are used in this process to permit the door to open or close for any person. In this technique of automatic temperature sensor, the LED is used to provide an idea to people that he or she is allowed or not in a particular place. IoT has been designed with the Serial monitor that provides a visual of temperature every 5 seconds in Arduino software that provides an accuracy of body temperature of people.

4.2.2 Software Details

In this process, Arduino software is used to keep a record of the information of temperature and it is also used in this process to sense the temperature without any contact with a person. Arduino IDE (integrated development

environment) is a cross-stage software that is written in C++ and C limits that unanticipated spikes sought after for macOS, Windows, and Linux [14]. This software is used to transfer the information to other sheets in this program. It can change the code of the program as required for the development or error mitigation. The software is used to manage to code for temperature sensing and control the door of any place. This software updates the code and uploads the sketch that helps to blink the LED to manage the door and provide permission for the person to enter any place.

4.2.3 Hardware Details

In this research, some hardware is used to manage the sensing process and design the IoT. Servo Motor, LEDs, Breadboard, Arduino UNO R3, Temperature Sensor, and Connecting wires. Servo motor in an Automatic Temperature Sensor plays a role to provide the suggestion to open or close the door for any person. LED plays a role to provide the understanding to the visitors that they are permitted or not [15]. The breadboard is used in this process to manage connections and a temperature sensor is used to sense the temperature of people and get information of high or normal temperature of people. The wires are used in this process to connect all the hardware systematically and get a positive and accurate result in the sensing process [16]. Arduino Uno is a microcontroller board reliant upon the ATmega328P (datasheet) and it is used to maintain software.

4.2.4 Testing

In the research, two kinds of tests have been done and first is in room temperature water and the second is in hot coffee. The first test result has come that the green LED has blinked which means the result of temperature is normal and positive. On the other hand, the result of the second test has come that the red LED has blinked, which means the result of the temperature is high and negative.

4.3. Discussion

In this case, it can be discussed that this ATS can be effective to check the temperature of people and allow people as per the result of ATS in public gatherings. This can mitigate the risk of the spread of coronavirus in a population by using this system in many places.

5. CONCLUSION

The above study has discussed the importance of ATS in risk mitigation. The system design and the result of the test of the tool help to get an understanding of the temperature of people in a social gathering. ATS also helps to allow people in a social gathering after checking the temperature of people. In addition to that, in this process, the IoT has been designed through UML coding and using Arduino IDE and library in this process. As per this research result, it can be recommended that the ATS can be used in shopping malls, movie theatres, and supermarkets. This research

can help other scholars to get information on automatic temperature sensors' importance in a population and the mitigation process of risk for the Covid-19. The establishment of this system can help others to reduce the impact of Covid-19 and get rid of the spread of Covid-19 in India and global countries.

REFERENCES

- [1] Purnomo, A.T., Lin, D.B., Adiprabowo, T. and Hendria, W.F., 2021. Non-Contact Monitoring and Classification of Breathing Pattern for the Supervision of People Infected by COVID-19. *Sensors*, 21(9), p.3172.
- [2] Iskandar, D., Nugroho, E.W., Rahmawati, D. and Rozikin, I., 2021. Automatic Door Control System With Body Temperature Sensor. *International Journal of Computer and Information System (IJCIS)*, 2(4), pp.111-114.
- [3] Kumar, K., Kumar, N. and Shah, R., 2020. Role of IoT to avoid spreading of COVID-19. *International Journal of Intelligent Networks*, 1, pp.32-35.
- [4] Mac Síthigh, D. and Siems, M., 2019. The Chinese social credit system: A model for other countries?. *The Modern Law Review*, 82(6), pp.1034-1071.
- [5] Dave, B., Buda, A., Nurminen, A. and Främling, K., 2018. A framework for integrating BIM and IoT through open standards. *Automation in Construction*, 95, pp.35-45.
- [6] Sharma, P., Arora, D. and Sakthivel, T., 2020. UML-based process model for mobile cloud forensic application framework-a preliminary study. *International Journal of Electronic Security and Digital Forensics*, 12(3), pp.262-278.
- [7] Rastogi, V. and Shivam, P.M., 2018, June. Authorship Detection in Cyber World. In 3rd National Conference on Image Processing, Computing, Communication, Networking and Data Analytics (p. 318).
- [8] Prihandoyo, M.T., 2018. Unified Modeling Language (UML) Model Untuk Pengembangan Sistem Informasi Akademik Berbasis Web. *Jurnal Informatika: Jurnal Pengembangan IT*, 3(1), pp.126-129.
- [9] Nagadi, K., Rabelo, L., Basingab, M., Sarmiento, A.T., Jones, A. and Rahal, A., 2018. A hybrid simulation-based assessment framework of smart manufacturing systems. *International Journal of Computer Integrated Manufacturing*, 31(2), pp.115-128.
- [10] Bruneliere, H., Burger, E., Cabot, J. and Wimmer, M., 2019. A feature-based survey of model view approaches. *Software & Systems Modeling*, 18(3), pp.1931-1952.

- [11] Anderson, F., Grossman, T. and Fitzmaurice, G., 2017, October. Trigger-action-circuits: Leveraging generative design to enable novices to design and build circuitry. In Proceedings of the 30th Annual ACM Symposium on User Interface Software and Technology (pp. 331-342).
- [12] Costanzo, S. and Flores, A., 2020. A Non-Contact Integrated Body-Ambient Temperature Sensors Platform to Contrast COVID-19. *Electronics*, 9(10), p.1658.
- [13] Saha, R., Biswas, S., Sarmah, S., Karmakar, S. and Das, P., 2021. A Working Prototype Using DS18B20 Temperature Sensor and Arduino for Health Monitoring. *SN Computer Science*, 2(1), pp.1-21.
- [14] Tamilselvi, V., Sribalaji, S., Vigneshwaran, P., Vinu, P. and GeethaRamani, J., 2020, March. IoT based health monitoring system. In 2020 6th International conference on advanced computing and communication systems (ICACCS) (pp. 386389). IEEE.
- [15] Ballard, Z.S., Shir, D., Bhardwaj, A., Bazargan, S., Sathianathan, S. and Ozcan, A., 2017. Computational sensing using low-cost and mobile plasmonic readers designed by machine learning. *ACS nano*, 11(2), pp.2266-2274.
- [16] Aghenta, L.O. and Iqbal, M.T., 2019, May. Development of an IoT Based Open Source SCADA System for PV System Monitoring. In 2019 IEEE Canadian Conference of Electrical and Computer Engineering (CCECE) (pp. 1-4). IEEE.