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Design and Modelling of Automatic Temperature Check and Sanitization System Using Raspberry Pi

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Abstract

As COVID19 virus is becoming very threatening, it has made the biggest pandemic ever faced all over the world. The pandemic situation cannot be controlled immediately but by taking safety measurements virus spread and infection can be avoided. Health safety, sanitization and hygiene maintenance must be top priority for all people and should be followed positively. So, to ease the process of safety measurement, this process can be automated with Automatic Temperature check and Sanitization system using Raspberry Pi. With implementation of this system safety of people in the public places can be assured. This system is helpful in body temperature check of people, sanitization and also with the crowd control. This system will ensure that only safe and sanitized people will enter public place such as banks, shops, offices etc. The main advantage of this system is that, it is automatic process so manual work effort, time and human to human virus spread is avoided.

Keywords-*Covid19, Temperature check, Sanitization, UV disinfection, Safety measurement*

I. INTRODUCTION

In the current situation the world's biggest problem is COVID 19 virus so there was need to get safety measurement and to avoid getting infected. Most of the people are feeling extra challenged to do our work in this situation.All the people are operating with limitations in our life than usual, the anxiety of the pandemic, and less contact with others than you normally have. And after lockdown over people are getting to new normal, they have to undergo basic health checks and sanitization everywhere which is manual work. This manual work takes lot of time, efforts and also increases risk of getting infection.

According to the world Health Organization (WHO) more then 110M people infected by this Covid19 virus and More than 2.5M people lost their lives due to this virus and this number is increasing day by day. Therefore, until every people gets the vaccine all need to take some health measurements and keep ourself safe when going outside home for our work especially in public places like banks, offices etc.

The worldwide pandemic situation has given an insight in exploiting emerging technology to design and develop a basic health check and sanitization system as part of a first-line protection measure. In this connection, this System has a two stage approach; firstly, to design and build an non-contact infrared (IR) thermal temperature measurement system and Ultraviolet-C spectrum (UV-C) disinfection station. This system will automatically detect the person approaching toward it, and then check the temperature using non-contact temperature sensor (ts118-3 thermometer), and if

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the temp is above pre set limit the system will not give entry to the people. But people having body temperature below limit can also check their pulse oximeter and heart rate. After basic health check measurements people can sanitize their hands using automatic sanitizer dispenser. Also there is UV-C chamber for sanitization of hard items like bags, mobile phones, keys etc. In this system crowd management can be done by limiting the number of people inside the public place by using people counter. If the number of people inside place exceeds new entry will be restricted at entry point.

II. LITERATURE SURVEY

Research on the temperature measurement technology of infrared thermal imaging and its applications review [1] It explains the basic principles of infrared thermal imaging technology are introduced, and the related literatures in the fields of military, medical, electric power, industry, architecture, agriculture and forestry are summarized in recent years.

Non -contact infrared temperature Measurement [2] where they developed a Infrared thermometer for high temperature object under the premise of high measuring accuracy and low cost.A quick and accurate surface temperature measurement of an object was realized. It also concludes that The instrumentation engineer must take great caution when making the decision of using the noncontact temperature devices to realize selected temperature measurements.

Design and Modelling of IoT IR Thermal Temperature Screening and UV Disinfection Sterilization System for Commercial Application using Blockchain Technology[3].In this paper they used blockchain technology to store the and keep track of data of person on the monitoring system. They used Infrared thermal scanning with a camera (Thermovis-Mi-FRAHT-800). To capture person and measure the body temperature.This system designed with a precautionary measure that requires3 conditions to be met for the automated barrier to be open which include temperature measurement, disinfection, and sanitization processes.

Flat panel UV-C light source with CNT cold cathode electron beam (C-beam) [4] where they developed flat panel UV-C light generation technique with the electron beam pumping technology using carbon nanotube (CNT) emitters.Flat panel UV-C light generation efficiencies depend on the anode biases and current densities. With the optimized C-beam and anode, they could obtain UV-C with wavelength of 269.5 nm. Flat panel UV-C light source would be applied to many industries because advantages of flat areal light source.

Directional People Counter Based on Head Tracking [5] this paper presents an application for counting people by using a single fixed camera. This system performs the count distinction between input and output of people moving through the supervised area.

III. TECHNOLOGY USED

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This is sensors and controller-based system. The technology used in this system is non-contact temperature sensor, IR sensor, heart rate and oximeter sensor, DC motor these electronic components are controlled by raspberry pi controller. For automatic temperature measurement ts118-3 temperature sensor is used. For sanitization purpose automatic sanitizer dispenser and UV-C chamber for disinfection purpose is used.

A. Temperature sensor

To detect temperature of human body by using non-contact sensor require infrared thermal screening. Infrared thermal sensor works as Infrared Temperature Measurement System for the body having a temperature above the absolute zero(- 273.15°C = 0 Kelvin) emits an electromagnetic radiation from its surface, which is proportional to its intrinsic temperature.A part of that intrinsic radiation is infrared radiation, which can be used to measure a body's temperature. This radiation penetrates the atmosphere. By using lensthat is input optics the beams are focused on a detector element, which generatesan electrical signal proportional to the radiation. The signal is amplified and processed, using successive digital signal processing and transformed into an output signal proportional to the object temperature. The display is used to show the measured value.

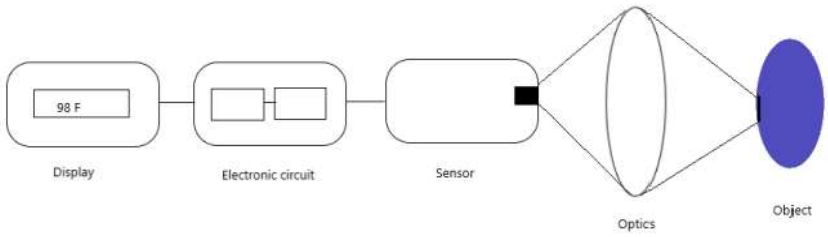

Fig.1 Infrared Thermal Measurement

B. UV-C chamber

UV light base disinfection system shows a lot of promise and it is based on the wavelength of the light. e UV-C light (200–280 nm) is completely absorbed by our atmosphere and never reaches the surface of the earth. According to (Dana, 2020) research already shows that germicidal UV can effectively inactivate airborne microbes that transmit measles, tuberculosis and SARS-CoV-1, a close relative of the novel coronavirus.At this juncture, advancement in UV-C (ultra violet spectrum C) led technology which is an area of the electromagnetic spectrum is a relatively new frontier for solid- state lighting and consequently, forms as the promising solution for purifying air and water and for inactivating microbes.

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IV. PROPOSED WORK

C. *System working*

- This system is sensor and controller based. As shown in architecture diagram all the sensors are connected to the controller
- Here IR sensor is used to detect the person approaching the system.
- Temperature sensor is used to measure the temperature of that person which will be displayed on LCD
- Automatic sanitizer dispenser will dispense sanitizer for sanitization.
- Max30102 is pulse oximeter and heart rate sensor this data again displayed on the display.
- UV chamber is used to disinfect hard and other items such as bags, mobile phones etc.
- This system entry will be given by rotor bar which is controlled by DC motor only if the temperature of person is within limits.
- People counter is simple IR sensor-based person detector counter which is used to count the entered people. With this the entry can be restricted when count reaches the limit.

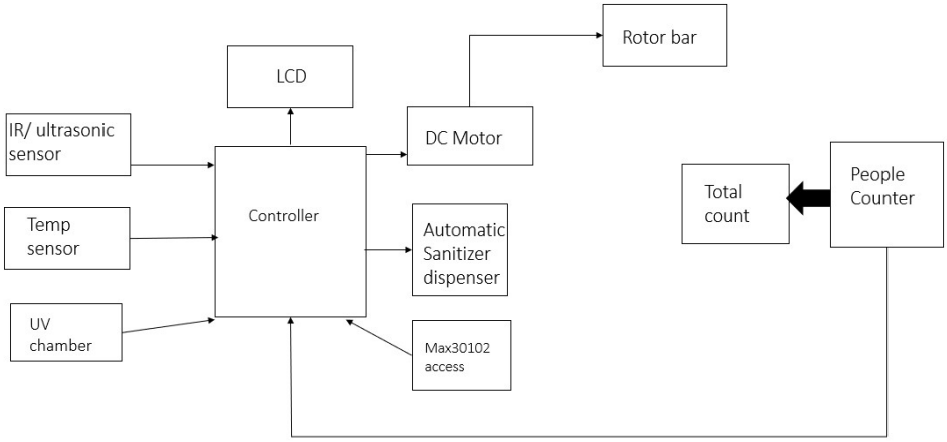
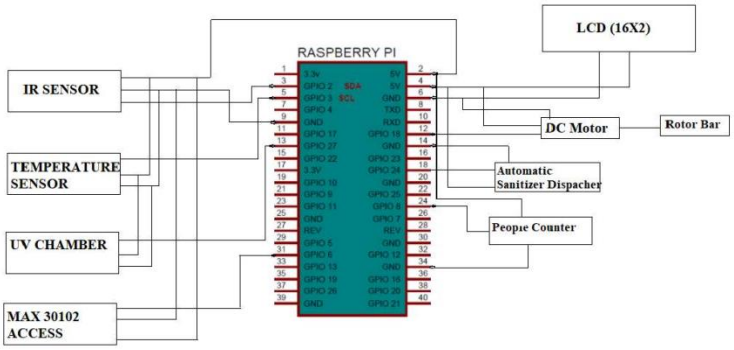


Fig.2 System Architecture

D. *Controller*

This proposed System requires a controller to control all the sensors and actuators. For that raspberry pi 3 is used as a controller. It is easily available pocket-sized controller having multi connectivity ports like Ethernet, Bluetooth, Wi-Fi etc. and also it is faster and powerful compared to other controllers.

Raspberry Pi is a fully-fledged computer with CPU, integrated GPU, RAM, network interface card, in-built camera interface port, USB controller, and GPIO controller for interfacing with electronics. It runs on an operating system (most commonly Raspbian, which isLinux customized for the Raspberry's on-board hardware) and application software (written in any language, from assembly or C to Java, Python, PHP, Haskell, Scratch) on top of that.



E. Implementation, workflow and design:

- When any person approaches to our system sensor detects the person and start the checking the temperature. If the temp is normal then the person is allowed entry and automatic sanitization is done.
- If the temp is above the limit the person is not allowed to enter and entry is restricted.
- Every entered person is counted by controller. So that it keep the count and limit the entry so social distancing is maintained in public places.

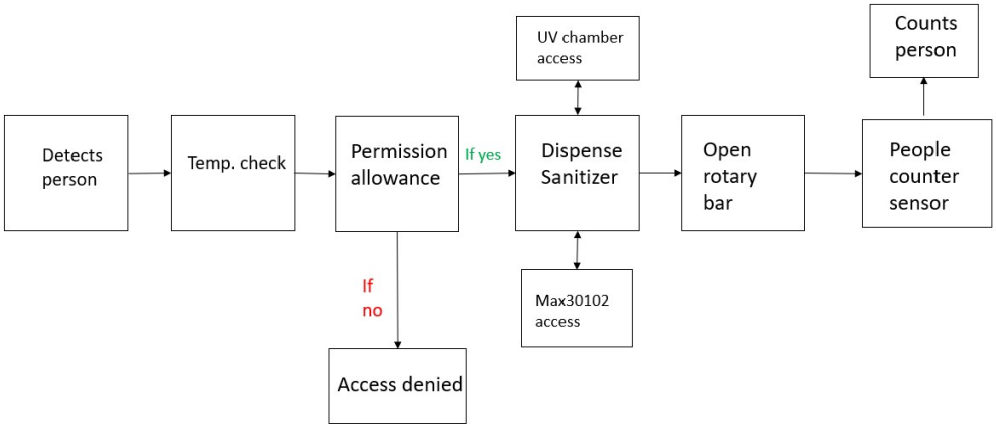
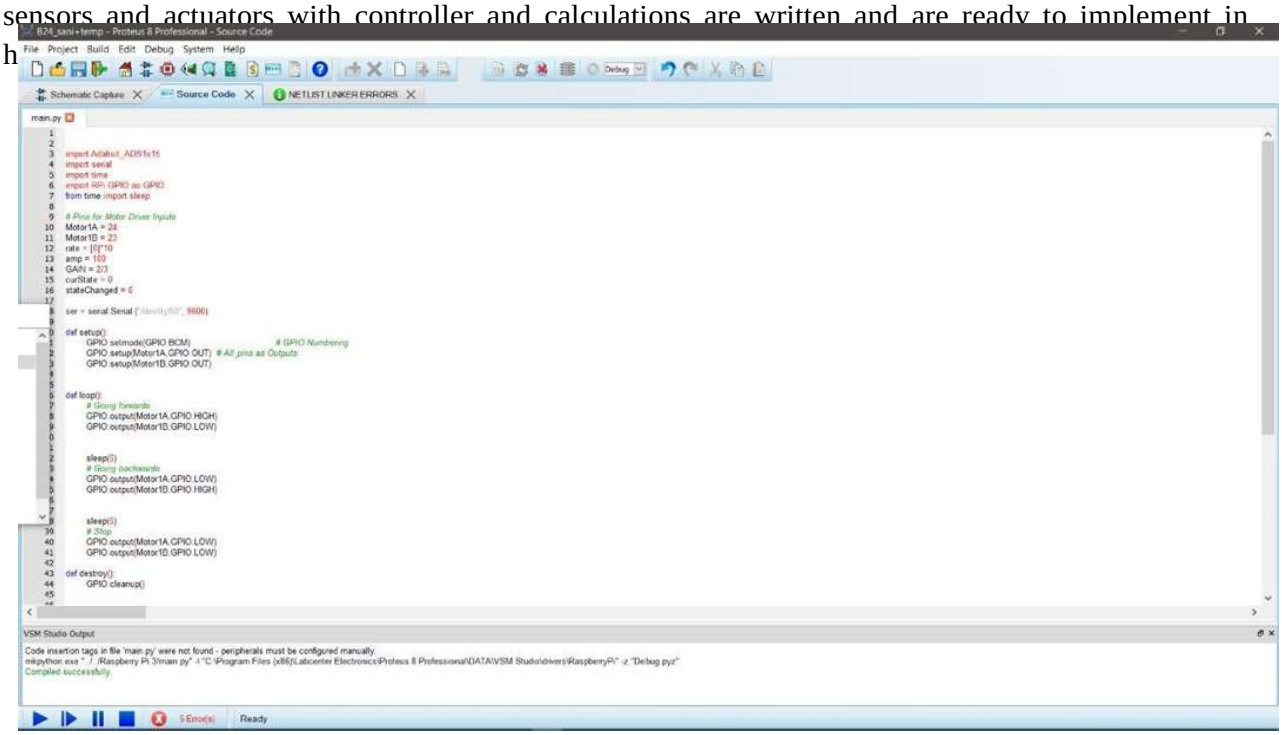


Fig.4 System Workflow

V. RESULTS

For this system simulation of raspberry pi with sensors is not feasible in proteus or in any other software. it can be only performed on hardware. In Software part python code for interfacing of sensors and actuators with controller and calculations are written and are ready to implement in h



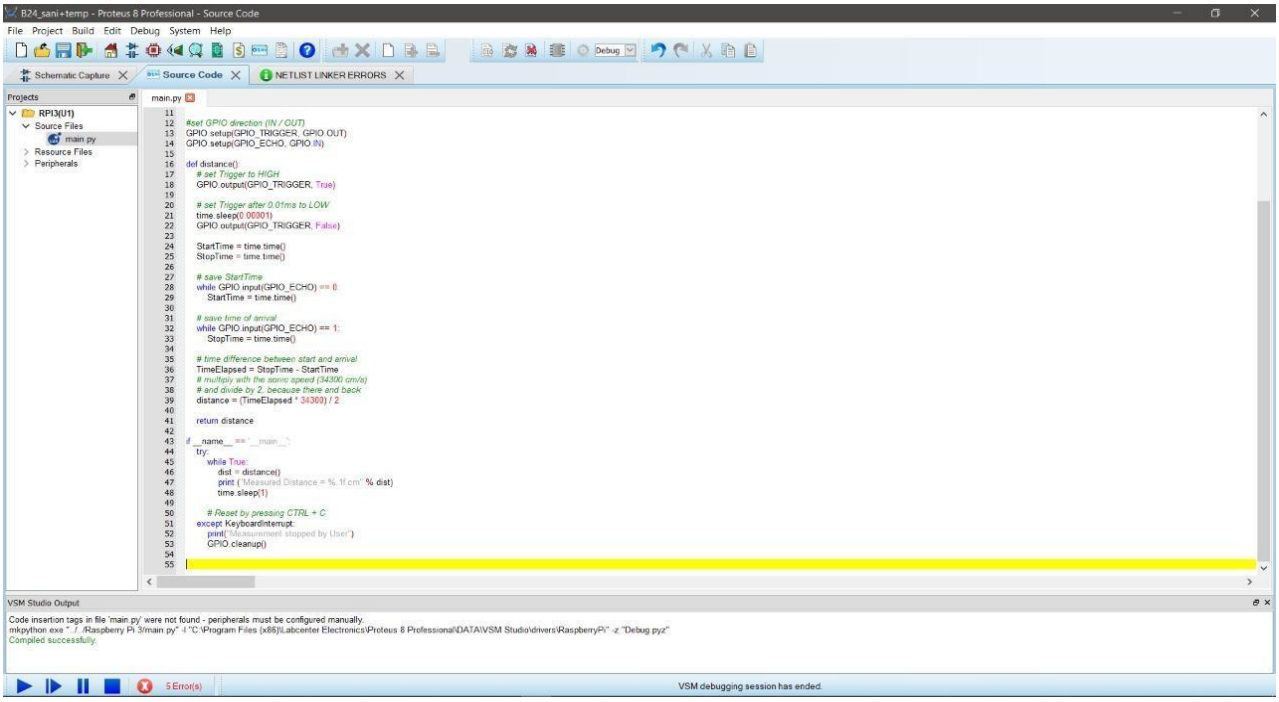


Fig. 6 Simulation code result-2

Here above images are showing the python code for interfacing of sensors with controller and its calculations. After writing code for software, these are tested. All the codes of interfacing are compiled successfully and running without any errors. It shows that these software codes are ready to implement in the hardware system so the system will be working smoothly.

VI. CONCLUSION

With the implementations of this System, lots of human effort and time can be saved in this current pandemic situation and also helps to follow standard operating protocols set by authorities. As the system will be fully automatic and human less, it avoids the direct contact with monitoring staff so the saved manpower (health worker) can be used in other work.It will also ensure safety in crowded area and make it safe working environment. This system would be foundation to follow safety measure for infection control using latest technology.

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