

TIRD-Robot

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ABSTRACT—Medical service in most hospitals starts with examining basic parameters like temperature and pulse rate checking. In high volume cases taking these measurements will become a hectic task for medical workers. In current covid situation the health workers will be more exposed to the spreading of virus. Maintaining proper social distance is much needed. Storing the data collected is important since it can be useful for knowing the person's health status. By measuring the basic parameters primary health monitoring can be done. The COVID-19 pandemic has led to a dramatic loss of human life worldwide and an unprecedented challenge to public health. By avoiding in-person contact with individuals who may have COVID-19 disease, healthcare workers can prevent disease transmission. Robots can play a vital role during the present pandemic as they can minimize human intervention at all levels, starting from the patient examination. A health monitoring robotic system can solve the problem and will provide much needed relief for medical workers with high volume cases. By avoiding contact with person infected health workers can prevent disease transmission. The robotic system includes non-contactless temperature detection, face recognition and storing the information in a database, self-sanitization of robot using UVC and telemetry system is added for doctors and patients to come in contact virtually.

Keywords— Thermal imaging, face recognition, monitoring, my SQL, Internet of Things, UVC Sanitization

I. INTRODUCTION

The world is grappling with corona virus. Preventing the spread is the only solution available. Most often all medical

devices start with patient's temperature measurement. The ordinary temperature measurement is done by using stick type or glass thermometer under current scenario using traditional method. Is not possible. Thermal scanners can be used but it also need a person to handle the devices. Therefore, this scheme is not a best solution. According to temperature can be measured using thermal cameras. In this robot thermal imaging technique for temperature measurement. Temperature can be measured a range of about 5-7 meters. This robot self-sanitize automatically using UVC sanitizer. UVC sanitizer is also provided under the robot which helps to disinfect floor. The robot is three-wheeled and the movement is controlled by wi-fi module.

II. PROBLEM STATEMENT

Because of the covid 19 pandemic there where many problems and protocols should be followed by the people for the existence of humanity. all the organization keep a rule in checking the temperature of person for verifying weather the person is affected by fever, for this purpose a person is assigned for checking temperature and this may be arising a chance of spreading of virus and also people forget to sanitize their hands to remove virus to certain extend.

III. EXISTING SYSTEMS

1. "Lio - A Personal Robot Assistant for Human-Robot Interaction and Care Applications Justinas Miseikis, Pietro Caroni, Patricia Duchamp, Alina Gasser, Rastislav Marko, Nelija Mišėikienė, Frederik Zwilling, Charles de Castelbajac, Lucas Eicher, Michael Fruh, Hansruedi Fröhlich"

Recently robots are gaining popularity

outside the factory floors and entering unstructured environments such as homes, shops and hospitals. Given the difficulty of ageing population and shortage of medical and nursing staff in many countries, this naturally results in attempts to use robotics and automation addressing this problem. Lio, a private assistant robot for care applications, can complete a good variety of complex tasks. It can handle and manipulate objects for applications in health care institutions and residential environments. Furthermore, it operates autonomously in an existing environment without requiring significant adaptations for its deployment. Room disinfection is vital measure to prevent the spread of the virus, especially in hospitals. Lio was adapted to hold out disinfection using an approved UV-C light capable of effectively killing exposed germs, bacteria and viruses on the surfaces.[3].

2. "Mobile-platform for Automatic Fever Screening System based on Infrared forehead Temperature Armote Somboonkaew, Panintorn Prempre, Sirajit Vuttivong, JutaphetWetcharungsri, supanit Porntheeraphat, Sataporn Chanhorm, Prasit Pongsoon,Ratthasart amarit, Yuttana Intaravanne, Kosom Chaitavon and Sarun Sumriddetchkajorn,."

Medical service in most hospital starts with patients' temperature measurement then screening fever patients. Core temperature are often accurately estimated by measuring axillary or oral temperature using stick type, or glass thermometers. However, these methods aren't convenient due to uncooperative patients, especially for young children, and time-consuming. Therefore, some hospitals start using an infrared forehead skin thermometer instead.

IV. SYSTEMS

I. Temperature Detection System

A. Temperature detection is done by Thermal imaging. All bodies emit some kind of infrared radiation and it is one way of heat transfer. A thermal camera captures infrared radiation and translates it into heat energy. Cold temperatures are given in shade of blue, purple, or green while the warm temperature can be assigned a shade of red, orange, or yellow. Infrared cameras are sensitive to wavelengths from about 1000nm to 1400 nm. The lens of the thermal camera focuses the infrared energy into a set of detectors that create a detailed pattern called a thermogram. The thermogram is then converted into electrical signals to create a thermal image. These are commonly used in the long-distance measurement of temperature that is what we need in the present situation. The temperature measurement ranges from about 0-85 degrees Celsius. The output is of digital form and is connected to the raspberry pi. The image is processed and the output is stored in the database.

II. Face recognition System

Face recognition is a technology that identifies a person from a digital image. It can be done using OpenCV. OpenCV python is the python API for OpenCV. It is fast and easy to code. Four steps involved:

i. Face detection

It is performed by using classifiers. A classifier is an algorithm. OpenCV has two predefined classifiers they are Here classifier and Local binary pattern classifier.

ii. Face analysis

The photo of the face is captured and analyzed. Face recognition software will analyze model points such as distance between the eyes shape of checkboxes. Face recognition mainly relies on 2D imaging since it is more convenient to match the 2D image with those given in the collected database.

iii. Converting Image to Data

The analysis of the face is then converted into a mathematical formula. The facial features become numbers in a code. This numerical code is called face print. Each person has their faceprint.

iv. Finding Match

The faceprint is compared with the database until a match is found. The match is returned with the attached information like name and other details.

III. Database

Data is stored in MySQL. It is an open-source relational database management system. A relational database refers to a database that stores data in a structural formal using rows and columns. My SQL itself is written in C and C++. It is a tool used for creating a database, collecting data, storing data, putting data on a cloud server, etc.

IV. UVC Sanitizer

UVC radiation is a known disinfectant for air, water, and non-porous surfaces. Light-emitting diodes that produce UV radiation are used here. UV LEDs used here will emit a wavelength of a maximum of 222 nm which won't be harmful to humans. UVC radiation has been shown to destroy the outer protein coating of the SARS-COV-2 Virus which is the Coronavirus. The robot is using UVC radiation for self-sanitization and also disinfecting its surrounding surfaces, walls, etc. UVC LEDs are installed at the bottom and for disinfecting the surroundings and it's different parts for self-sanitization.

V. Heart beat detection

Pulse sensor is used for heart beat detection. Pulse sensors use photoelectric method. Depending on the measurement method it is classified into transmission and reflection. Transmission types measure pulse waves by emitting red or infrared light the body surface and detecting the change in the amount of light transmitted through the body. Optical pulse sensors are of reflection type.

VI. Movement Control

Three-wheeled movement is implemented. There are one servo motor and two dc motors. A high torque servo motor is attached to the front wheel. The other two wheels are together connected to Arduino. The control is done by a wi-fi module.

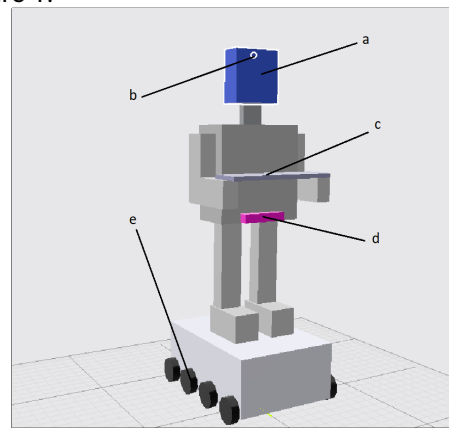
VII. LCD Display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for

consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

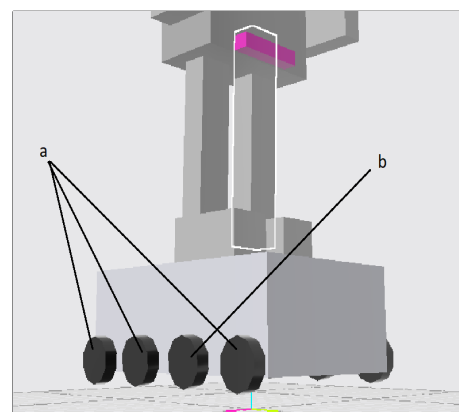
V. ROBOT PROTOTYPE

The overall structure of the robot is shown below in Figure 1. the purpose of this structure is to capture the face of peoples and display the values in the screen on the robot. The keyboard attached to the robot is used to enter the name of people for identification purpose in face recognition. The camera will first take picture when the person appears and once image is captured it will check with the previous database whether there is any existing user with same photo. if not, the robot will ask to enter the name of the person through keyboard and will pronounce and cross check with the user. Then the system asks to put their hands at the sensor shown in figure 1.



- a. lcd display ; c. keyboard ; e. wheel
- b. camera ; d. sensor and uv-c led

Figure 1. Robot



- a. wheels attached with motor ; b. wheel without motor

Figure 2. Wheel base

The wheel base is designed in such a way that carry a load of 15 Kg and supply the required amount of torque to move the robot. Here we use 6 - 30 RPM motors for the wheelbase and one free running motor to support the weight in the wheel base

$$N_s = \frac{120 f}{P}$$

Where,
 N_s- Synchronous speed (RPM)
 f - Frequency (Hz)
 P - Number of Poles

Figure 3. RPM Equation

The material for designing the structure is acrylic sheet of thickness 4mm and the box are setup by screw and bolts. The wheel base is done using plywood with great thickness so that the chance of bending will be less.

VI. PROPOSED SYSTEM

The project is divided into 2 stages

1. RC controlling
2. Covid assist

Covid assist

Temperature, pulse rate, and a person's picture are provided as input signals. A USB camera is used to scan the images. Temperature is measured with an analog LM35 sensor. A pulse sensor is used to determine the rate of heartbeat. Self-sanitization is done with UV-C lamp. Raspberry Pi 3 B+ is the controlling unit. Controlling, picture identification, storing outputs and transmitting them to the server and controlling UV-C lamps are among the functions.

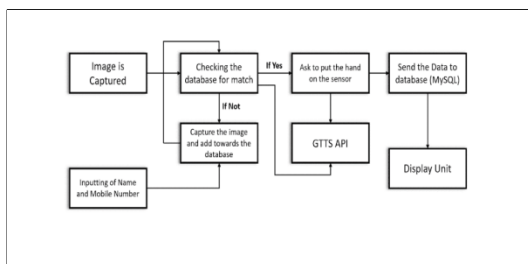


Figure 3. Flow Chart

The covid assist part works with Raspberry Pi 3 B+ . The algorithm is written using python. The flow of algorithm is shown in Figure 3. The system starts with capturing of image through camera attached to the USB port of Raspberry Pi. Once the image is captured will check with the dataset that trained before. the training is done through OpenCV using Haar-cascade. while training there will be a .yml created at the location of code which is the training file, the system will capture 30 samples of persons while training. In this system the training will automatically begin if the person is not available in database. The system will check the details of person in previous database. if the details are not available, we can enter through keyboard. After this process the system ask to put hands -on sensor for a short time. for the proper communication we have added a audio module so that the person will be alerted to put hands on sensor at the right time. The sensors will take values from hand and the system stores in locally hosted database using php MyAdmin. php MyAdmin is software used to setup server at local system. using MySQL we created the database. when login at 127.0.0.1/index. The value will be listed like a table. The sensors take the value and using GTTS API (Google Text to Speech) the value will be announced. These data are then send to Database and then to the display attached to the Raspberry Pi. After 20 Seconds for the sanitizing of the sensor the UV-C lamp will be turned on after the value is sensed.

Libraries Used

- OpenCV
- MySQL
- NumPy
- PIL - Image

RC Controlling

The microcontroller is connected to a Bluetooth module and is controlled via an Android app. For data processing, an Arduino is employed. Motor Shield is used to control DC motors. The motor drive used her is L298.The Arduino and raspberry pi will be connected using an UART connection because to stop movement when the face recognition process happens. Otherwise, the system will get collapsed.

VII. CIRCUIT DIAGRAM

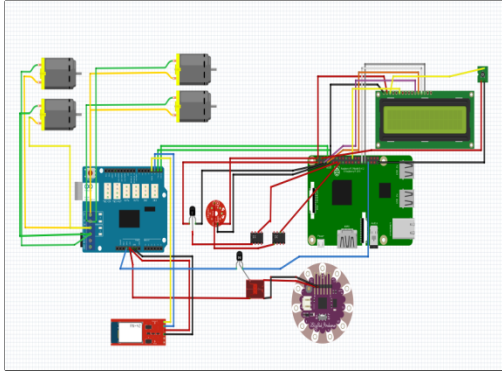


Figure 4. Circuit Diagram

VIII. BLOCK DIAGRAM

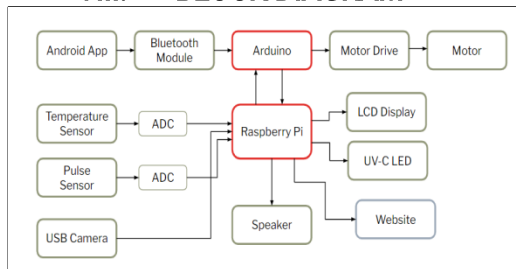


Figure 5. Block Diagram

IX. FUTURE SCOPE

- In prototype we use **LM35** sensor, in future we will be using **Thermal camera**. Thermal camera can measure from an object from **5** meters.
- Adding UID to the system (Aadhar) for public use.
- The structure will be made using **3D printing** rather than foam sheet.
- Motion of Robot will be autonomous.
- Complete sanitization of robot using UV-C constantly at particular time period
- Covid Detection using AI.
- Heavy duty battery (Li) with less mass will be replaced from current system.

X. CONCLUSION

Robots play a vital role during the present pandemic as they can minimize human intervention at all levels, starting from the patient examination. This robot's

significance in this covid-19 is that it can measure the temperature of the patient without having contact with him and also other health parameters. Expected outcome is health monitoring which includes non-contact temperature monitoring, heart beat detection, oxygen measurement, face recognition and self sanitization of the robot using uvc. Also, a telemetry system is added for doctors and patients to contact virtually, and if the doctor is not available online, an alert will be sent.

REFERENCES

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