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Literature review on "Hybrid temperature sensing and monitoring system with built-in sanitizer"

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Abstract: COVID-19 is a widespread viral disease that has caused enormous loss of the populations around the world. The virus specially targets the respiratory organs like lungs. The spreading of virus starts with the droplets of the infected person's sneeze, cough or breath which can be present in the air or any surface. If this surface comes in contact with either nose, eyes or ears through hands will give the virus a passage to the mucus membrane and down to the throat. After contact in 2 to 14 days the person may show few symptoms like itchy throat, cough, increase body temperature(fever), breathlessness etc. So as precautionary measure protecting our nose with face masks is essential, with sanitizing hands and monitoring the body temperature from time to time. Hence usage of automatic sanitising dispensers at the entrance of the organization can prevent the spread of viral disease.

Keywords: Hybrid monitoring system, STT, Contactless, All in one

I. INTRODUCTION

On November 17 2019 a new virus emerged which created a history. No one could ever imagine the virus attack would turn into Pandemic until declared by the World Health Organization (WHO) on March 11th 2020.A massive population has been victim all over the world. China was the first country with a widespread outbreak in January followed by other countries like Italy, USA and more. Today December 2020 nearly 71,462,822 confirmed cases and 1,601,628 deaths are recorded around the world. The death cases rose from virus that had no known treatment or vaccine. Countries shut their borders, banned travel to other countries and began to issue orders to citizens to stay under Lockdown which went for months in some countries. With the efforts of the Government the spread was under control in some countries while others still struggled. The pandemic is a huge loss to everyone and the employment rate drastically reduced, causing many to lose their Jobs. With the heating situation it is really important for us to take precautions in order to keep us safe and avoid the infection spread further. Many countries have begun their daily routines considering the social distancing and other precautions like wearing face masks and sanitising the hands from time to time which is made mandatory. Every organization's security guard has to check the temperature of the individual entering.
In this paper we aim to build an all in one and cost-effective contactless monitoring system for any organisation which has built in a sanitizer dispenser, temperature sensing system which records the temperature of every individual and then store into a database. This model eliminates the dependency of a human to record the data on a daily basis and is contactless which reduces the risk of the infection spread.

II. LITERATURE SURVEY:

[1] Measurement of Temperature and Humidity by using Arduino Tool and DHT11

In this paper the process is divided into 3 steps:

- The 1st process is to measure the temperature using DHT11 sensors
- The 2nd process is to extract the output of the DHT11 sensor output in Celsius scale.
- The 3rd process is displaying the temperature recorded on an LCD.

The system connection is based on single wire serial communication. First Arduino sends a start signal to the DHT module and then DHT gives a response signal containing temperature data. A liquid crystal display is used for displaying temperature and humidity which is directly connected to Arduino in 4-bit mode.
This sensor has a resistive type humidity measurement component and NTC type temperature measurement component with an 8-bit microcontroller inbuilt which has a fast response and cost effective and available in 4-pin single row package. The DHT11 module works on serial communication. And the whole process time is about 4ms. It is ensured that the nested wired systems can be replaced by the wireless sensor networks to get accurate data as well as to avoid many hazardous issues.

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[2] Design and Development of Arduino Based Contactless Thermometer

Here Arduino UNO, MLX90614 temperature sensor, OLED Display and a battery is used for developing this system. The thermometer built here has a wide range of -70 to 380˚C temperature measurement, has a resolution of 0.02 with an accuracy of 0.5˚C and is accessed by 2 wire serial SM Bus compatible protocol. Unlike traditional thermometers, the proposed thermometer does not need any contact to measure the temperature.

When the Arduino is powered on, the MLX90614 measures the temperature of the body/object in its range. The range is provided by a led/IR light for accurate target of desired object or body. This temperature is displayed using OLED.

[3] Automated Social Distancing Gate with Non-Contact Body Temperature Monitoring using Arduino Uno

The incoming person's body temperature is measured using MLX90614ESF-BAA-000-TU-ND non-contact IR temperature sensor and the temperature is displayed on a 4x20 blue LCD as soon as IR sensor GP2YOA21YK detects the forehead at a distance of 150cm. A buzzer of 0.5 watt, 8 ohms is used to notify the detection of abnormal temperature i.e., 37.5 degree Celsius or above. Also a speaker is used to indicate the same.

MLX90614ESF-DCx versions of the infrared thermometer sensor can be used instead of MLX90614ESF-BAA-000-TU-ND for better accuracy.

[4] Design of a contactless body temperature measurement system using Arduino

Here an Arduino CT uno controller, a type of Arduino mega controller is used to monitor the temperature parameters. Two sensors LM 35 as S1 and MLX-90614 as S2 are used for temperature measurement. LM35 is a contact type sensor and gives a precise output in the range -55 degree C to 150-degree C. Whereas the MLX-90614 is a contactless sensor. The S1 senses the ambience temperature where output voltage is directly converted into temperature in Celsius and S2 senses the human body temperature through PWM output pins. The esp.-WIFI shield is a programmable microcontroller that is used to transfer and monitor the collected temperature data both wired and wirelessly and also displays the data in the online portal.

[5] RFID based Contactless Body Temperature Screening using Arduino and MLX90614 IR Temperature Sensor

When a person scans his RFID card, EM18 RFID Reader sends the data to the microcontroller Arduino nano, using UART communication. Now the temperature of the person is measured using a non-contact infrared thermometer using MLX90614 sensor. The temperature is measured only when the person is less than 25cm from the thermometer, an ultrasonic sensor is used for this purpose. This temperature is noted against the name read through RFID reader directly to an excel sheet.

This is also an attendance system which stores the temperature of every person. As this is not a completely contactless way of reading RFID tags, the possibility of spreading infection exists. Also, lack of RFID users in most of the places leads to lower number of users.

[6] Design of Automatic Hand Sanitizer with Temperature Sensing

Here there are two systems which work simultaneously, the first one is automatic sanitizer and second is the temperature sensing. The ultrasonic sensor PING SEN136B5B is used to detect the range of the human and the PIR sensor is used to monitor the motion of the human. The range of PIR sensors is 5 to 12m. Any detection of humans will activate the sanitizer pump1 and the sanitizer is sprayed and a blower is used to spread the sanitizer to the surroundings. Ultrasound sensor has a range less than 30m, any detection of human hand in that range will activate pump2 which sanitizes the hands using a DC motor.

Temperature sensor TMP 36 senses the temperature as soon as the contact is made, the sensor displays the temperature on the LCD display in Fahrenheit. A RGB led is made to glow green when the temperature is normal else it is made to glow red when the temperature is higher than normal and a piezo electric buzzer is used for the same.

The system has an efficient automatic sanitizing development but fails to provide a contactless temperature measuring unit, which can lead to spreading of infection.

[7] Arduino UNO and GSM Based Wireless Health Monitoring System for Patients

The microcontroller is the heart of the system used here. An LM35 sensor is used to detect the temperature of the human body, when the temperature greater than normal temperature is detected, an SMS alert is issued using GSM module. The GSM module is used as RS232 serial communication interface and an alert SMS is sent via a GSM network which works via AT commands. This Arduino UNO with GSM module is easy to use, works quickly and can be used for long distances with lesser cost.

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[8] Design and Implementation of a Smart Hand Sanitizer Dispenser with Door Controller using ATMEGA328P – June [2020]

In this paper, ATMEGA328P microcontroller is used to develop an automatic hand sanitizer dispenser with door controller. When the person goes near the device, their presence is sensed through an ultrasonic sensor, where it will emit ultrasonic frequency from one side and note down the time taken for the sound wave to get reflected back. When the sensor senses the presence of the hand at an approximate distance of 10cm or less than that, it causes the servo motor to move from 0 degrees to 180 degrees in order to pour the sanitizer gel on hand. The time delay of 2 seconds is taken by the servo motor to go back from 180 degrees to 0 degrees. After sanitizing the hand, the electromagnetic door gets de-energized and a second servo motor will get activated which opens the door. The time taken to complete this procedure is around 8 seconds.

The major drawback of this device is the time taken to complete the full procedure.

[9] A Novel Automatic Sanitizer Dispenser [2020]

In this paper, the microcontroller used is Arduino nano which is smaller in size compared to other microcontrollers such as Arduino uno, ATMEGA328P. This automatic sanitizer dispenser consists of ultrasonic sensors which are used to sense the presence of the hand within a certain distance of 7-10cm. When there is presence of the hand within the required range, the sound waves from the sensor are sent to the Arduino nano which in turn triggers a relay board to activate the motor which causes the pumping of the sanitizer.

A relay board used between DC motor and Arduino because the required voltage for the DC motor to pump is 12V but the Arduino cannot generate more than 5V. The time taken to complete the whole procedure is approximately 4 seconds. The drawback of this model is that there is no option for an external power supply source through the battery.

[10] Self-Activating Sanitizer with Battery Imposed System for Cleansing Hands [2020]

This paper speaks about battery imposed automatic sanitizer systems. AHWSWM microcontroller with Switch Mode Power Supply (SMPS) is used to control the whole setup. Battery Management Mode (BMM) is used for charging and discharging the battery. IR sensors are used to detect the presence of the human hand. The motor connected to RC timer delay pumps the sanitizer. RC timer delay is used to control the flow of sanitizer (2 to 3mL). LEDs are used considering the understanding of the user.

White LED indicates the system is in working mode and battery is in use. Red LED glows when the battery is charging and Green LED glows when the battery is fully charged.

The drawback of this system is battery replacement for the system usage.

[11] Automatic Water Level Controller with Short Messaging Service (SMS) Notification [2014]

This paper deals with automatic water level controllers with SMS notification. Whenever a system encounters low levels of water, a SMS notification is sent to the user using Global System for Mobile (GSM) technology. The system uses a battery for power supply and an Arduino uno is used as a controller. Sensor senses the level of water in the tank and is continuously given to the controller. If the empty level is encountered in the water level, a relay coil is energised using NPN transistor and SMS is sent to the user.

Extra care to be taken as water is used as the
conducting medium.

[12] Microcontroller Based Speech to Text Translation System [2019]

The heart of this project is ATMEGA328P microcontroller. The speech input is given through the microphone of the android phone which is received by adaptive multi-rate audio application and is synchronised by the Bluetooth module. Understanding of the voice command and translation into string of characters is done by google voice search application. These characters are being interfaced to the microcontroller by serial communication through Bluetooth module. The string of characters are converted into digital text and displayed on LCD using MAX232 and RS232 cables.

Drawbacks:

- ➢ Environmental noise interference is one of the major drawbacks of this model.
- ➢ There is no storage system for storing the converted texts for future purposes.
- ➢ Only English language with a clear accent was converted into text.

[13] Speech-To-Text Conversion (STT) System Using Hidden Markov Model (HMM) [2015]

Speech to text conversion is classified into two types such as speaker dependent and speaker independent system. In this paper, a speaker dependent speech recognition system is discussed.

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Speech signal features are extracted using Mel Frequency Cepstral Coefficients (MFCC) and spoken words are recognised by using Hidden Markov Model (HMM). The data size of speech signals is reduced by feature extraction before recognition. Unwanted noise is filtered using the end point detection method. Speech is converted into text using MATLAB.
The drawback of this system is that MFCC values are not very robust in the presence of additive noises. Normalisation is required.

[14] Speech to text and text to speech recognition systems [2018]

In this paper, speech to text conversion methods is discussed. One of the methods is Artificial Neural Network Classier (ANN) based on Cuckoo Search Optimization. This method is used for removal of unwanted noise by pre-processing the speech signal and these are fed as input to the high pass filter. ANN is used as a classifier with n input nodes, 1 hidden node and k output nodes.
Two layered Feed Forward Back Propagation Neural Network is used for implementation of ANN. It has two input units (MFCC and LPCC), three hidden units and one output unit. These features are fed as input which gets trained and corresponding outputs are produced.
Not effective in modelling time-variability of speech is the drawback of this system.

[15] SOFTWARE ASSISTANT USING RASPBERRY PI [2019]

This paper is based on building a Software Assistant using Raspberry pi 3 model. This software assistant is just a prototype of the role "Jarvis" in the movie "Iron man". This prototype operates on the user's voice commands. This software uses three concepts which are speech to text conversion (STT), logic engine and text to speech conversion (TTS). The STT model converts the audio input which is the speech into text string using the Natural language processing (NLP). The converted text string is processed using the logic engine which is developed by Artificial intelligence and IOT technology. Here the user queries are handled by python programming interfacing with Raspberry Pi 3. The logic engine decides the output based on the response of the input in the STT model. The output of the logic engine which is the text string is converted back to Speech through the TTS model to complete the user interaction, using the Linux's inbuilt software named 'espeak'.
The only drawback of the approach is its need for the internet for wide applications of voice commands. The offline local module is limited to voice commands.

[16] Speech Recognition Based Wireless Automation of Home Loads- E Home [2015]

This journal paper aims to design and implement a cost-effective Home automation system using Zigbee wireless communication module and MATLAB software through voice recognition. This system is implemented by SMS technology that is used to transfer data from sender to receiver over GSM network. The system consists of the following components. (i) automatic speech recognition (ASR) system, (ii) control units, (iii) wireless system and (iv) application and home appliances. The system has two main sections; they are MATLAB section and embedded section. The MATLAB section uses a PC with MATLAB software for speech processing and recognition. The speech recognition is done with the help of MATLAB coding. After recognition, corresponding control characters are sent through the ZigBee transceivers to the control part. Microcontroller in the control part will select the required device according to the input voice command. The devices can also be controlled from distant locations through SMS so a GSM module is used
The ZigBee technology is short ranged and data speed is slow which is a major disadvantage when used for wide applications.

III. PROPOSED WORK:

Due to the spread of the novel coronavirus across the globe, a set of rules called as the standard operating procedure is made mandatory by the government of India, which includes thermal scanning and hand sanitizing at the entry of public places, shared work place, shopping malls, institutions etc., in order to control the spread of the infection.
This project aims to build a system which can automate these set of rules, with the help of a non-contact temperature checker and an in-built sanitizer system that senses the presence of hands and pumps sanitizer with the help of a DC motor.
A database is created using excel sheets in order to store the name and temperature of the individual entering the place. A red LED and a buzzer are used to indicate high temperature thereby closing the doors and when a high temperature is detected an SMS alert is sent to the head of the organization and also a SMS is sent when the sanitizer level goes below the threshold level. A green LED is used to indicate normal temperature and a motor is driven to open the doors.

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IV. CONCLUSION

Our model 'Hybrid Temperature and monitoring system with built in sanitising system' is proposed considering the human life at risk of the covid-19 infection spreads. This is fully automatic, use of this hybrid system at the entrance of the various crowded places can reduce the man work who is also subjected to risk. Spread of infection is under control due to no contact. Since controlling the doors are also automated, it is ensured that every individual follows the rules accordingly. This is a cost efficient and an all-in-one model and hence

does not require any multiple systems to support the model. The feature of automatic updating into the database will certainly reduce the human involvement of recording the temperature of every individual manually and save time. This model suits the need for every organization to maintain the temperature record of the employees daily along with automatic intimation to the higher authority in case of increased temperature of any individual through the GSM module which is a great advantage.

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