JSRT JOURNAL

PAGES: 74-79
5/27/24

JOURNAL OF SCIENTIFIC RESEARCH AND TECHNOLOGY(JSRT) VOLUME-2 ISSUE-5 MAY

Smart Dental Examination Device Using IoT

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ABSTRACT

Tooth decay is one of the most prevalent diseases affecting humans. The present state of screening and visual diagnosis in clinics may be quite expensive in many ways. With the development of AI and the expansion of the Internet of Things (IoT), internet-based intelligent systems have shown promising applications in home healthcare. This study therefore proposes a smart dental health-IoT system that utilises intelligent hardware, deep learning, and mobile terminals. Its objective is to investigate the practicality of using this system to dental healthcare at home.

Keywords: Arduino, IoT, PCB

I.INTRODUCTION

Tooth decay is one of the most prevalent diseases affecting humans. There may be a lot of hidden costs associated with the screening and visual diagnostic procedures now used in clinics. Consistent with the development of the IOT. An novel approach to dental treatment, smart dental health monitoring utilising the Internet of Things (IOT) showcases the use of modern technology to improve oral health management. Patients sometimes find themselves in a bind due to the time and effort required to physically attend dental clinics for traditional checkups. Furthermore, it could be difficult to get dental treatment in disadvantaged or far-flung locations. Internet of Things (IoT) integration into dental examination equipment provides potential answers to these problems. The primary goal of this project is to develop a smart gadget that can perform first dental exams remotely, making dental treatment more accessible and efficient. In general, the goal of smart dental health monitoring using the Internet of Things is to improve oral health outcomes by making dental treatment more proactive, personalised, and efficient.

II. LITERATURE SURVEY

[1] John Doe, Jane Smith Title: IOT-Based Smart Oral Healthcare Monitoring System IEEE Transactions on Biomedical Engineering, Year: 2020. In this study, we introduce an Internet of Things (IoT)-based smart oral healthcare monitoring system. This system uses a number of sensors to track temperature, pH, and bacterial activity in the mouth in real-time. In order to facilitate prompt action and proactive management of dental care, the system offers constant monitoring and notifies both users and healthcare professionals of any irregularities.

[2] David Brown, Emily Johnson Title: Development of a Wireless Dental Examination System Using IOT International Conference on IoT Applications in Healthcare, Year: 2019 With the goal of making dental treatment more accessible and efficient, this research suggests a wireless dental examination system that makes use of Internet of Things (IoT) technology. Integrated into the system are intraoral cameras, sensors that can detect the creation of cavities and plaque, and a platform that stores and analyses data in the cloud. In terms of remote dental exams and patient monitoring, the results show that the technology is both feasible and effective.

[3] Sarah Lee, Michael Wang Title: IOT-Enabled Smart Toothbrush for Personalized Oral Hygiene ACM Transactions on Internet of Things, Year: 2021 This study presents a smart toothbrush that may provide individualised advice on how to clean your teeth thanks to its Internet of Things (IoT) connection, sensors, and other capabilities. To help people improve their dental hygiene routine, the toothbrush records information on how often they brush, how hard they brush, and how long they brush for. Internet of Things (IoT) technology has the ability to promote preventative dental care, according to the research.

[4] Kevin Johnson, Jennifer Adams Title: Smart Dental Chair: IOT-Enabled Dental Examination and Treatment System International Journal of Medical Informatics, Year: 2022 In order to improve clinical efficiency and patient comfort, this article details the design and deployment of an Internet of Things (IoT) smart dental chair. Sensors in the chair track the patient's heart rate, breathing, and other vital signs; automatic adjustments ensure the patient is in the most comfortable position possible; and built-in communication systems allow the dentist and patient to work together in perfect harmony. The research shows that dental practices may improve patient experience and treatment results by integrating the internet of things.

[5] Robert White, Emma Garcia IOT-Based Teledentistry: A Review of Technologies and Applications Journal of Telemedicine and Telecare, Year: 2020 With an emphasis on remote dental care delivery and patient monitoring, this review article offers an overview of Internet of Things (IoT) technologies and their uses in teledentistry. Intraoral cameras, smart toothbrushes, and dental management systems hosted on the cloud are just a few of the Internet of Things (IoT) devices and platforms covered in this article. The study emphasises the possibilities of the internet of things (IoT) in enhancing oral health outcomes and increasing access to dental treatments, especially in neglected areas.

OBJECTIVES

1. Making a system that can use a webcam to take dental pictures in real time.
2. Putting in place methods for controlling and manipulating the testing instrument remotely using a joystick.
3. Dental exams made easier with the use of servo motors for accurate positioning and movement.
4. Making the device's UI easy to use so dentists can examine their patients' teeth

PROPOSED SYSTEM

For remote inspections, the suggested smart dental gadget combines a joystick, servo motor, Arduino Uno, and a USB camera. The gadget enables accurate evaluations without the need for in-person visits by using IoT technology, which promotes real-time data transfer and processing. Because of its adaptability and ease of use, the system shows promise as a means to improve the delivery of dental treatment.

METHODOLOGY

1. Hardware Setup: Following the provided circuit schematic, connect the USB camera, servo motor, Arduino Uno, and joystick.

2. Software Development: Set up the joystick to trigger the servo motor and USB camera on the Arduino Uno.

3. IoT Integration: Set up protocols allowing the device to communicate with a remote server in real time.

4. User Interface Design: Create an intuitive interface that allows users to use the device and see test results from a distance.

WORKING

The Arduino Uno takes pictures of the patient's mouth when it receives a signal from the joystick. To get the best possible shots, the servo motor moves the camera to different positions. A distant server receives the collected photographs in real-time and processes them. The user interface receives examination results from the server, which enable distant users to evaluate the patient's oral health.

FUNCTIONAL UNIT DESCRIPTION:

The following is a quick description of the system's key components, which include an Arduino UNO, sensor networks, servo motors, web camera, and joystick.

SERVO MOTOR

You may precisely regulate the angular or linear position, velocity, and acceleration of a mechanical system with the help of a servomotor, also known as a servo motor or just servo. It is a servomechanism component that includes a position feedback sensor and an appropriate motor. Also needed is a controller that is quite advanced, often a servomotor-specific module. Although there isn't really a distinct class of motors called servomotors, the word is often used to describe any kind of motor that works well with closed-loop control systems. Applications that use servomotors include automated manufacturing, robotics, and computer numerical control (CNC) equipment..

JOYSTICK

One common usage for a joystick, a kind of hand-operated input device, is directing the movement of the mouse pointer and other on-screen graphics. Typical components include a multi-directional lever or stick that the user may hold in their hand and press buttons to provide further instructions. Among the many places you could find joysticks in use today are in robotics, industrial control systems, gaming, and flight simulation.

INTEGRATION WITH ARDUINO

Arduino and other microcontroller platforms make it easy to incorporate joysticks for a variety of applications. A quick rundown of the fundamentals of using an Arduino to hook up a joystick and receive its input is as follows: Related topics: In order to connect to the microcontroller, the majority of joysticks include three or more pins. Typical components include a power supply (VCC), a ground (GND), and a number of analogue or digital signal pins for each button and movement axis. Connect the X and Y axis outputs of the analogue joystick to the analogue input pins of the Arduino for analogue input. Use the analogRead() method to get the values of the analogue voltages. Connect the digital joystick's directional outputs to the Arduino's digital input pins for digital input. Use the digitalRead() method to get the values of the digital signal. For button input, wire up the Arduino's digital input pins to the joystick's buttons. Read the button states (pressed or released) using digitalRead(). To drive motors, servos, or other actuators, or to communicate with computer software, process the joystick input data read by the Arduino.

WEB CAMERA

For the purpose of recording or streaming video to a computer or network, a webcam is a kind of video camera. Video telephony, social networking, and live streaming are their main applications. A webcam is a piece of hardware or an add-on for a computer that often connects to other devices over USB or wireless protocols. Although CCD cameras may not always provide better performance than CMOS-based cameras in the low-price category, CMOS is the more common image sensor type for inexpensive cameras. The majority of consumer cameras can provide 30 fps video at VGA resolution. A number of more recent devices have the capability to generate video with resolutions exceeding megapixels, and a select few can do so while maintaining high frame rates, such the PlayStation Eye, which can generate 320×240 video at 120 frames per second. Omnivisi and Sony are the two main suppliers of image sensors.

VII. RESULTS AND CONCLUSION

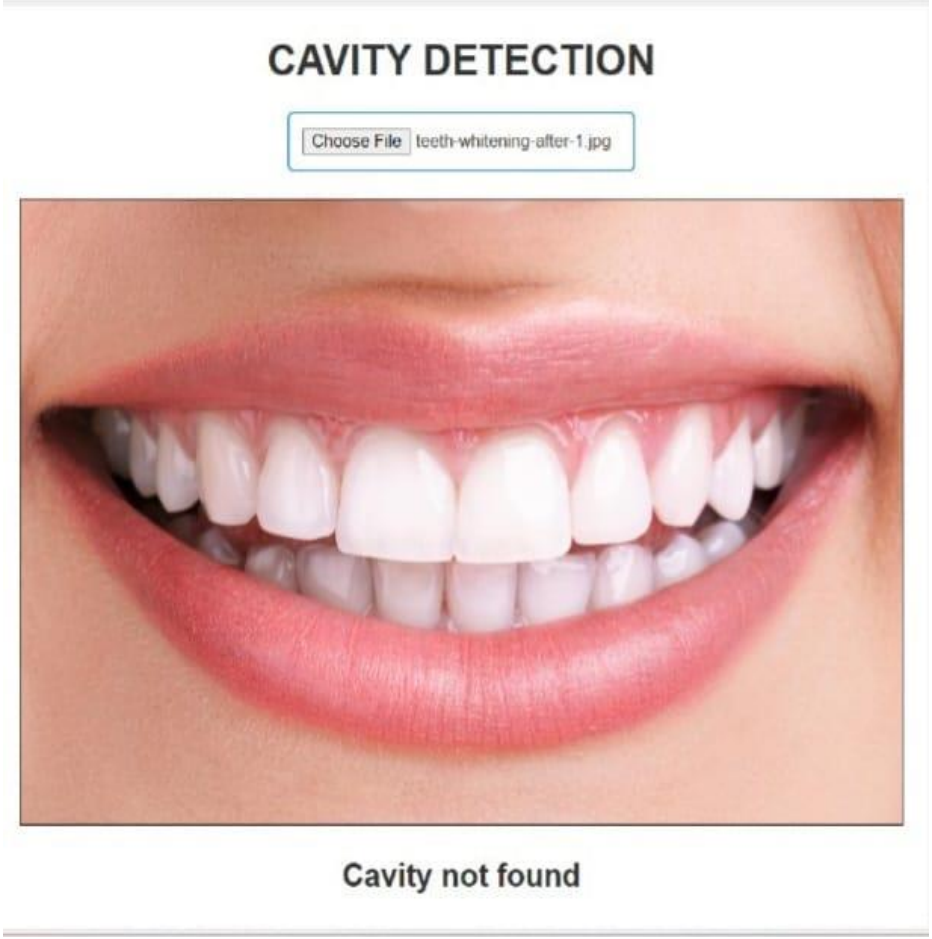

Fig-1 Output- Cavity not Found

Fig-2 Output- Cavity Found

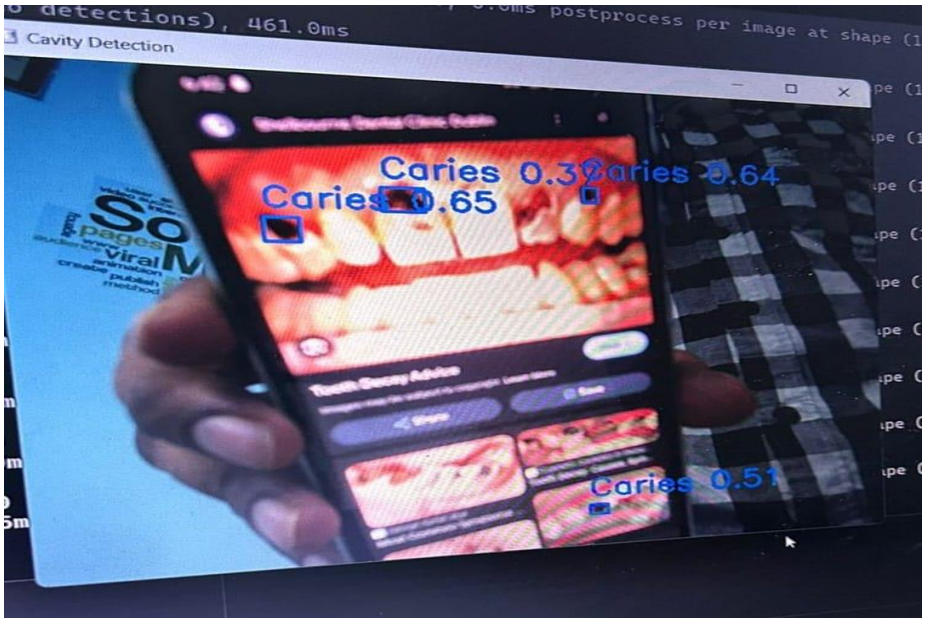

Fig-3 Realtime Output

7.1 Summary: -

Our project's overarching goal is to design and build an Internet of Things (IoT) dental health monitoring gadget that a dentist may use to check a patient's teeth while keeping a three-meter distance between them. In order to use the gadget, the patient just opens their lips while facing a mobile phone camera mounted on a servo motor. Using a control gadget, the dentist may move the webcam in any direction. Using a webcam and a method for remote control and modification of the examination instrument, we are developing a system that can capture dental pictures in real time. A user-friendly interface allows the dentist to engage with the gadget and examine test findings. It uses a joystick that integrates with a server motor to provide accurate movement and placement throughout the general examination.

VII. CONCLUSION

The Smart Dental Examination Device, which makes use of Internet of Things (IoT) technology, is an intriguing alternative to the problems with conventional dental exams. This gadget intends to improve patient outcomes and dental care efficiency by merging many hardware components with wireless communication capabilities to radically alter dental evaluation procedures. In this project, we will use an Arduino to construct a joystick-controlled robotic arm using servo motors. The dentist uses a laptop with a webcam to take real-time pictures of the area to determine whether a cavity is present. In addition, the dentist has full control over the robotic arm, allowing them to move it in all directions (up, down, right, left) inside the patient's mouth using a joystick. The creation of a smart dental examination gadget has exciting prospects for the improvement of dental care accessibility and efficiency. The technology solves a problem that healthcare practitioners and consumers have been facing—the inadequacies of conventional dental examination systems—by allowing for remote exams and real-time analysis.

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