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# Development of IoT Based Smart Asthma Monitoring Device

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***Abstract:*** ***IOT-based remote health monitoring systems for asthmatic patients have been developed by researchers to collect multiple health-related data from patients, including oxygen saturation, heart rate, body temperature, humidity, volatile gases, room temperature,and electrocardiogram, using various sensors. This system allows doctors to monitor asthmatic patients from a remote area, and the acquired data is sent to doctors for evaluationand consultation. The IOT-based smart monitoring systems can help in reducing the adverse effects of air pollution on asthma patients' health and can be beneficial for early detection and effective management of asthma, especially incountries with a high prevalence of asthma. Asthma monitoring through IOT is an emerging technology that allows doctors to monitor asthmatic patients remotely [1. This technology uses various sensors to measure vital parameters such as oxygen saturation, heart rate, body temperature, humidity, and volatile gases. The collected data is displayed in an application and transmitted to the doctor for real-time monitoring of the patient's condition.The proposed system is cost-effective, user-friendly, and can be beneficial for early detection and effective management of asthma, especially in countries with a high prevalence of asthma such as Bangladesh . The use of IOT-based smart monitoring systems for asthma patients can also help in reducing the adverse effects of air pollution on their health***

***Keywords: Ardunio, asthma, sensors, loadcell, zig-bee, Wi-Fi-module, IOT communicator.***

## I. INTRODUCTION

IOT-based asthma monitoring is a promising technology that can improve the accuracy, accessibility, and efficiency of asthma monitoring. By using sensors and wireless communication, IOT devices can collect real-time data on various parameters such as lung function, medication adherence, environmental factors, and lifestyle habits. The data can be analyzed using machine learning algorithms and displayed on a dashboard that can be accessed by patients, doctors, and caregivers. IOT-based asthma monitoring can also provide alerts and reminders for medication, appointments, and emergency situations. However, privacy, security, and data ownership issues need to be addressed to ensure the ethical and legal use of IOT-based asthma monitoring.

1) *The Patient:* Self-monitoring can be done using peak flow meters, symptom diaries, andwearable devices that can track vital signs.
2) *Healthcare Professionals:* Doctors and nurses can use spirometry tests, physical examinations, and medical history to monitor asthma.
3) *Caregivers and family Members:* They can observe and report any changes in the patient's breathing, behavior, and symptoms.

## II. PROPOSED SYSTEM

The Asthma Monitoring System is designed to provide a comprehensive solution for gathering, sending and receiving vital information from various sensors and external servers. It is intended toprovide a seamless access to vital information and services, thereby providing better patient healthcare services, efficient use of healthcare resources, and a rapid response from the hospital side in case of an emergency.

The microcontroller will play a crucial role in the system's architecture design, allowing for the efficient and secure transmission of data from the sensors to the external servers. The system will be designed to ensure that only authorized personnelwill have access to the data, and it will beincorporated with security protocols to ensure that the data is kept safe. The system will also be designed in a way that will allow for quick andefficient updates to the system, allowing for the latest technology to be incorporated into the system. With this system, the hope is that the quality of patient care will be improved, and the hospital's response time to emergencies will be shortened.

 

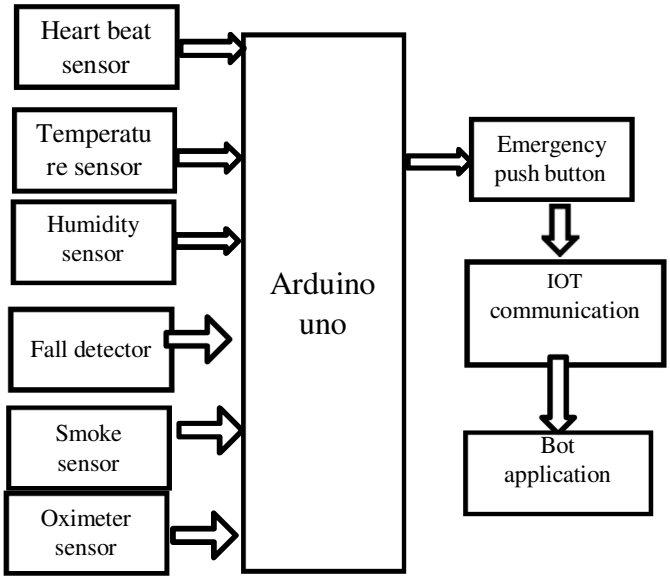


Fig-1:Block diagram

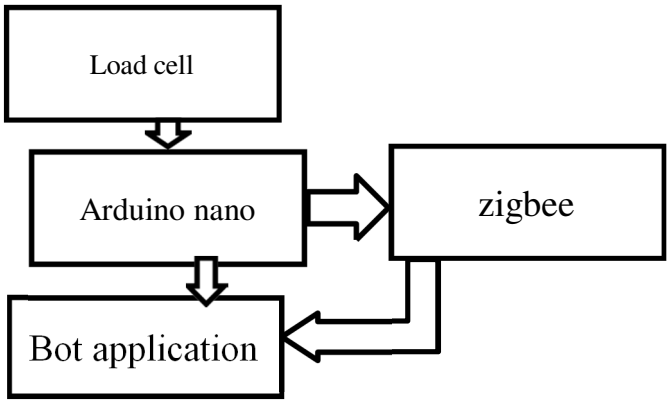


Fig-2: Block diagram

*A. Methdology*

The depicted individual framework can be helpful for consistent express observing of the state of an individual misery from bronchial asthma during the day and cautioning him about the need to take medication likewise, it very well may be helpful in clinical establishments for checking the state of a patient in emergency clinic, and checking the impacts of medications Generally, there are 2 gadgets that involve the model

First gadget is the Asthma Inhaler it has the following highlights:

*1)* Prescription monitoring when the amount of medicine in the in hailer drops below predetermined level1.It caution the patient and issues a warning via th application
*2)* Gas, moisture, temperature, and smoke location For asthmatics, breathing CO, methane, and hydrogen is dangerous. Alcohol is also on the list.
*3)* Complete the usage ofThe inhaler does more than merely record no The device also informs the doctor through the mobile application of how often it was used.

 

The subsequent gadget is the Versatile gadget. It has the following highlights

*a)* Temperature and heartbeat rate identification of the patient On the off chance that there are any irregularities in factors, an advance notice is shipped off the relatives and the specialist through the application

*b)* Crisis press button in the event of any crisis,this press button can be utilized to tell all the application clients also, the area of the patient is sent through thein built GPS module

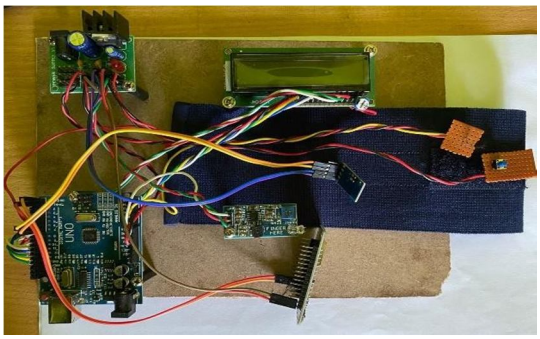

Fig-3 wearable device model

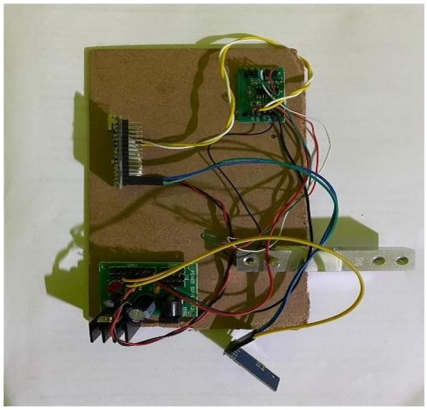

Fig-4:load cell device

## III. HARDWARE MODULES

### *A. Arduino Nano*

The Microchip ATmega328P microcontroller is supported by the open source, Arduino-developed Arduino nano microcontroller board.A number of expansionboards and other circuits will be interfaced to the board's sets of digital and analogue input/output (I/) pins. The board features 6 analogue pins, 14 digital pins, and through a type B USB connector, programmablewith the Arduino IDE (Integrated Development Environment). It may be powered by any voltage between 7 and 20 volts, but is frequently supplied bya USB cable or an external 9 volt battery.

*B. Temperature Sensor* (LM35)

A temperature measurement system with an analogue output voltage proportional to the temperature may use the LM 35 temperature sensor. It gives out voltage in degrees Celsius

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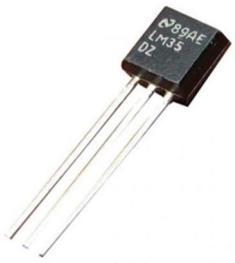



*C. Humidity Sensor (DHT11)*

The DHT 11 could be a simple, extremely affordable digital humidity and temperature sensor It lives the surrounding air using a capacitive humidity sensor and a thermistor and gives out a digital signal on the information pin (no analogue input connections are required). Although it's quite straightforward to operate, data collection needs precise scheduling.

Air that is both dry and humid might make symptoms worse (vomiting, etc.). Avoid air below 40 percent relative humidity. When the humidity reaches 55, it is problematic, and at 60 it becomes harmful for people with asthma. Since humidity is a significant factor, the patient should be extremely cautious while approaching the affected areas.

*D. Smoke Sensor*

A smoke detector could be a sensor that notices smoke as the main sign of a fire. We wish to act inertly and keep an eye out for two asthma aggravating activities in the environment of the asthma sufferer without being intrusive.Using the Foobot sensor, we can detect smoking and cooking in order to better understand and control asthma.

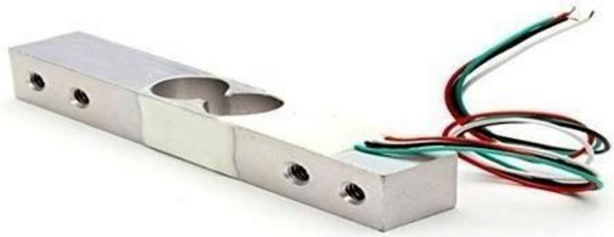

*E. Oxymeter Sensor*

The pulse oximeter, or Pulse Ox, is an electronic device that measures the saturation of oxygen carried in your red blood cells. Pulse oximeters can be attached to your fingers, forehead, nose, foot, ear or toes. This non invasive tool attaches painlessly to your fingertip, sending two wavelengths of light through the finger to measure your pulse rate and how much oxygen is in your system.

*F. Load Cell*

A load cell is a transducer that senses force andproduces an electrical signal from that force. While hydraulic and pneumatic load cells are also available, strain gage-based load cells are the most common. The load cell is utilised in this research to gauge the weight of the medication.



*G. Push Button*

A push button might be a basic switch mechanism for managing a particular feature of a machine or procedure. Usually, rigid materials like plastic ormetal are used to make buttons.

Typically, the surface is flat or contoured to fit a human finger or hand, making it simple to press or depress. The push button serves as an emergency button in this project. If the patient is experiencingan abnormal condition, the patient can use the push button to send a message to the physicians, nurses, and family members. If the patient is experiencing an abnormal condition, the message will be sent to the doctors, nurses, and family members.

## IV. COMMUNICATION MODULES

*A. ZIG-BEE Module*

The Zigbee Alliance produces Zigbee communication, which is specifically designed for control and sensor networks using the IEEE802.15.4 standard for wireless personal area networks.

Physical and Media Access Control (layers to manage numerous devices at slow data speeds) are defined in this communication standard. These ZigBee WPANs run on frequencies of 868 MHz,902 MHz, 928 MHz, and two 4 GHz. ZigBee is a mesh network that is commonly used for controllingand monitoring applications and has a range of 10 to100 metres.

In comparison to other proprietary short-rangewireless networks like Blue Tooth and WiFi, this communication technique is less costly and simpler. This project consists of two sections. In both portions, there are two components: one for the load cell and one for the hand gloves are communicating and exchanging data betweenthese two components utilising zigbee modules.

*B. WI-FI-Module (ESP8266)*

With an integrated TCP/IP protocol stack, the ESP 8266 WiFi Module might be a self-contained SOC that will provide any WiFi network connectivity for a microcontroller The ESP 8266 is capable of offloading all Wi-Fi networking tasks from another application processor or hosting an application. This module has sufficient internal processing and storage power to enable integration with sensors and other application- specific devices through its GPIOs with minimum preparation beforehand and minimal runtime loads.

## V. EXPERIMENTAL RESULTS

The portable wearable is employed for the followingpurposes:
Find out the temperature and humidity in the area.

*1)* Recognise the patient's pulse of heat.
*2)* Take the patient's body temperature into account.
*3)* Identify air quality metrics in the area.
*4)* Using zig bee and a Wi-Fi module, consult with physicians and clinicians to compare reports of asthma symptoms and exacerbations from patients with environmental variables without needing to be there in person.
*5)* Push button functions as an alarm to alert the physician and the emergency contact of the patient

The following are uses for the load cell device: Calculates the inhaler's weight, communicates with awearable device to correlate reports of asthmasymptoms and exacerbations from the patient's inhaler, and determines how frequently the patient takes medication.
We connected the two components using the ZigBee communication module, allowing us to get the outcome for both in the serial display For the benefit of the doctor, patient,and family, we may also view the output in the Blink and Telegram applications.

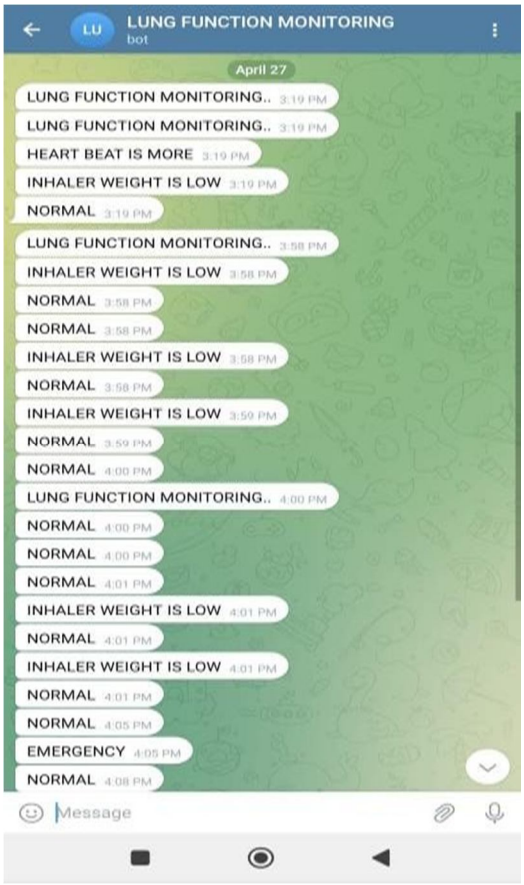
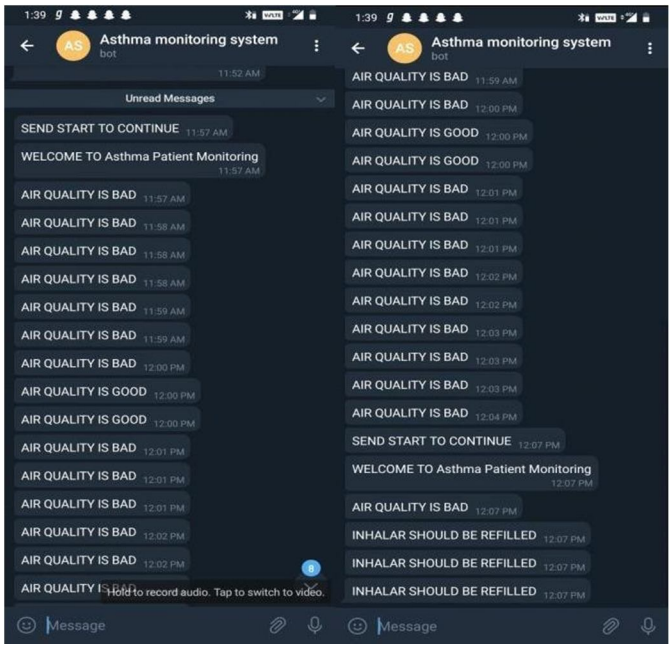



Fig:5 Result in application




To avoid mistakes when designing a replacement product, the engineer must thoroughly research allaspects of the idea. He must also be interested inintroducing a high-quality, low-cost, highly accurate, compact, and user-friendly product. Finally, theengineer must solicit customer feedback to improve his designs in the future.

Consequently, this research explores the potential for developing a portable system for detecting respiratory diseases. On the basis of a conveyable and a cheap patient status sensor, a system diagram is provided a tablet or smartphone that processes data Such a design will drastically lower the device's value, potentially enabling a larger distribution.

It is suggested to employ the tactic of monitoring the transmission coefficient of the microwave as the primary means of state control chest of the patient to transmit a signal In this scenario, measurements are only provided once, with the exception of lengthy periods of time, such as when the device is worn constantly throughout the day.

Due to the advantages of microwave technology, we may utilise the suggested structure to monitor the health of patients of various ages many parties, including small children A comprehensive system for monitoring the patient's condition and notifying him of the necessary actions during an urgent medical situation can be created by combining additional sensors for the patient's vitalactivity and, consequently, the environment with the use of modern IT technologies.

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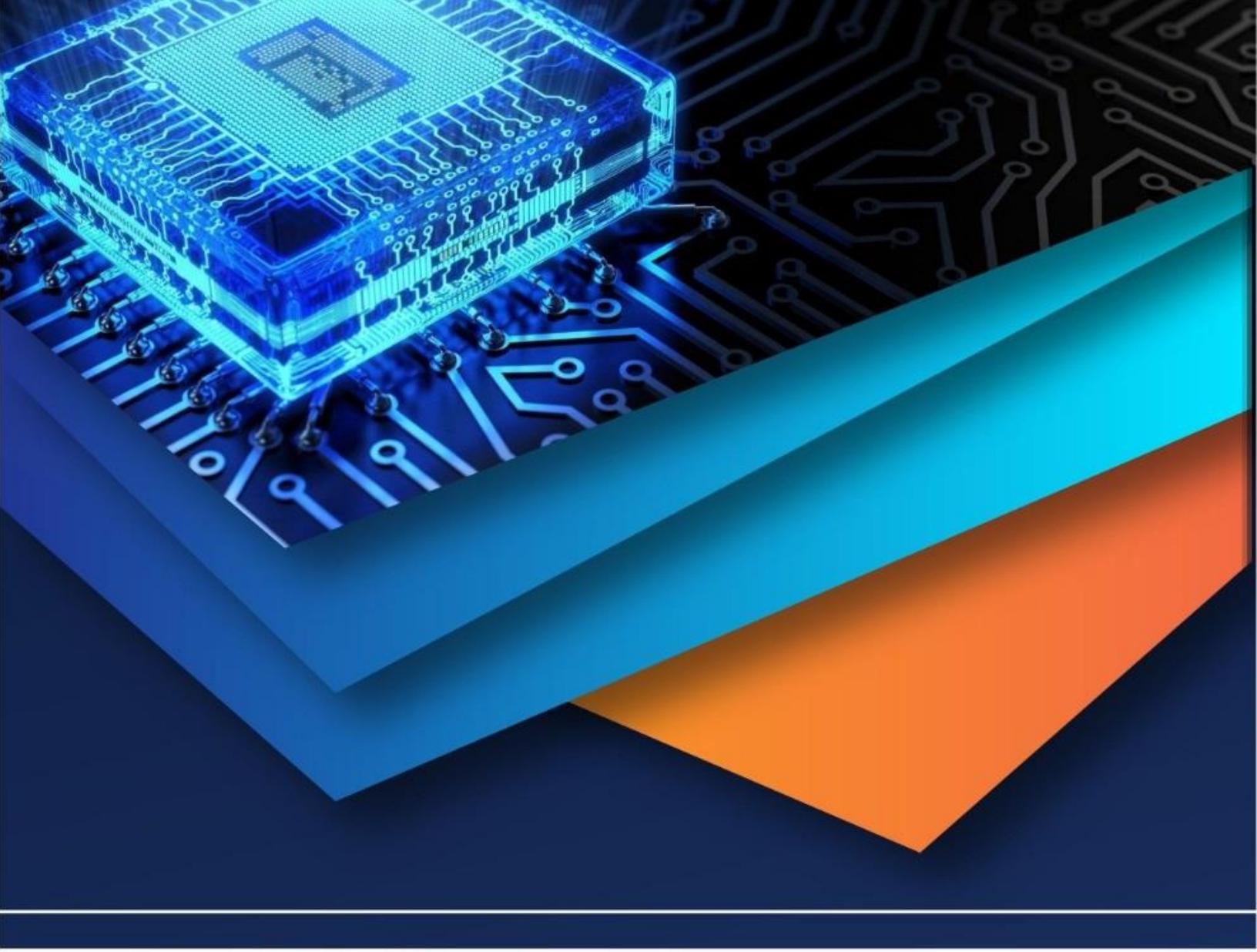

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