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Personal Health Care Smart Device For Asthma Patients

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ABSTRACT

In this time of epidemic Healthcare is given extreme importance. IOT based health monitoring is the best solution. In our project a portable physiological checking framework is displayed, which can constantly screen the patients pulse rate, temperature and oxygen. The temperature sensor measures the body temperature and oximeter measures the oxygen level and pulse of the patient when the patient is in contact (fingertip) with the sensors. It is a non-stop measuring instrument which sends data of patient to the IOT server using the Wi-Fi Module. In this system the authorized personal can access these data stored using IoT server and based on these values received, the diseases are diagnosed by the doctors from a distance.

Keywords: Healthcare, Smart device, IOT

I. INTRODUCTION

Asthma is one of the most prevalent chronic respiratory diseases in the world today, affecting both adults and children. According to the World Health Organization (WHO), over 260 million people suffer from asthma globally, and it is responsible for a substantial number of hospitalizations and deaths every year. The disease is characterized by inflamed and narrowed airways, which can be triggered by various environmental and physiological factors such as allergens, dust particles, weather changes, infections, or stress. For patients, especially those with severe asthma, the condition can become life-threatening if not monitored and managed promptly. This scenario emphasizes the importance of developing a real-time monitoring and alert system tailored to asthma patients.

With the evolution of embedded systems and wireless communication technologies, particularly the Internet of Things (IoT), healthcare systems have witnessed a paradigm shift. IoT offers smart, connected devices capable of collecting and transmitting real-time health data to remote caregivers and doctors. This enables early detection of anomalies and preventive measures before a critical situation arises. The increasing accessibility and affordability of microcontrollers, sensors, and wireless modules have made it feasible to build compact, low-cost, and energy-efficient monitoring systems that can operate in real-time.

The objective of this project is to design and implement an IoT-Based Patient Monitoring System for Asthma using ESP32 and various sensors. This system aims to continuously monitor key physiological and environmental parameters such as temperature, pressure, and air quality, and alert the patient or caretaker in case of dangerous readings. The main components include the ESP32 microcontroller, a temperature sensor (to detect fever or inflammation), a pressure sensor (to monitor ambient pressure or infer respiratory effort), and a dust sensor (to track particulate matter which often triggers asthma symptoms).

A buzzer is included to give immediate on-site alerts, and an I2C LCD is used for local data display. All data is sent to Blynk 2.0, an IoT cloud platform that enables remote monitoring through a smartphone app.

The ESP32 is an ideal choice for this project due to its built-in Wi-Fi and Bluetooth capabilities, low power consumption, and high performance. It acts as the brain of the system, reading sensor data, processing it, and sending it to the cloud. The Blynk 2.0 platform provides a powerful, customizable dashboard on a mobile device, making it easy for users to view real-time readings and receive alerts. The platform also allows data logging and analysis over time, which is valuable for healthcare providers.

This system is especially beneficial for high-risk asthma patients who need continuous monitoring. It can be used at home, in schools, or even in hospital settings where manual tracking is not feasible.

The design is cost-effective and scalable, allowing further enhancements like integration with wearable tech, GPS modules for emergency location tracking, or even machine learning models to predict potential asthma attacks.

This project addresses the critical need for proactive asthma management using IoT. By providing continuous monitoring, instant alerts, and easy remote access to data, this system can help reduce the frequency and severity of asthma attacks and improve the overall quality of life for patients. The integration of healthcare and technology exemplifies the future of personalized and preventive medicine.

II. LITERATURE SURVEY

[1] Cecily L.Bethave proposed “Smart Devices for Pediatric Asthma Management”.This paper provides review examines the use of smart devices for managing pediatric asthma, highlighting the need for further research on interoperability and limited sample sizes.The study presented in this paper is Limited scope of studies on pediatric asthma management using smart devices.

[2]Vera S. Hengeveld have proposed “eHealth Technologies for Monitoring Pediatric asthma”.This paper explores the use of eHealth technologies for monitoring pediatric asthma, emphasizing the potential benefits of wearable devices and mobile apps.In this Proposed paper Limited generalizability due to small sample sizes and variability in study designs.

[3]Rachel Merchant have proposed “Digital Health Intervention for Asthma” .This paper evaluates the usability and value of digital health interventions for asthma management, finding high patient satisfaction rates with digital health platforms and inhaler sensors.but in this paper Limited response rate (42.9%) and potential biases in self-reported data.

[4]Susanne J. van de Hei have proposed “Smart Inhalers for Asthma Medication Adherence”.This paper explores the perceptions of stakeholders on implementing smart inhalers in asthma medication adherence management, highlighting anticipated facilitators and barriers.But this paper is Limitedscope of study on specific stakeholder groups and potential biases in self-reported data.

[5]J.M.M. Driessen“Wearable Home Monitoring in Children with Asthma” .This study investigates the association between wearable home monitoring and hopital-based assessment of asthma control in children.but in this paper Limited sample size and potential variability in wearable device accuracy .

2.1 Objectives

1. To improve patient outcomes by enabling timely interventions and reducing the risk of complications.

2. To enhance patient care by providing personalized treatment plans and improving patient engagement

3. To reduce hospitalizations and emergency department visits by enabling early detection and treatment of asthma attack

4. To improve the quality of life for asthma patients by enabling them to manage their condition more effectively.

5. To reduce healthcare costs by minimizing hospital visits and enabling remote monitoring.

6. To improve patient engagement and empowerment by providing personalized care and treatment plans.

7. To enhance doctor-patient communication by providing real-time data and insights.

8 .To support personalized medicine by providing tailored treatment plans based on individual patient needs and medical history.

9. Support Data-Driven Decision MakingSupport data-driven decision making for healthcare providers by providing accurate and timely data on asthma triggers and patient outcomes.

10. Integrate with IoT Technology Integrate the device with IoT technology to enable seamless data transfer and remote monitoring.

III. OVERWIEW OF “PATIENT HEALTHCARE SMART DEVICE FOR ASTHMA PATIENTS”

The Personal Healthcare Smart Device for Asthma Patients is a wearable device designed to monitor asthma triggers and provide real-time feedback and alerts to patients. The device utilizes a range of sensors and technologies to track environmental factors that can exacerbate asthma symptoms.

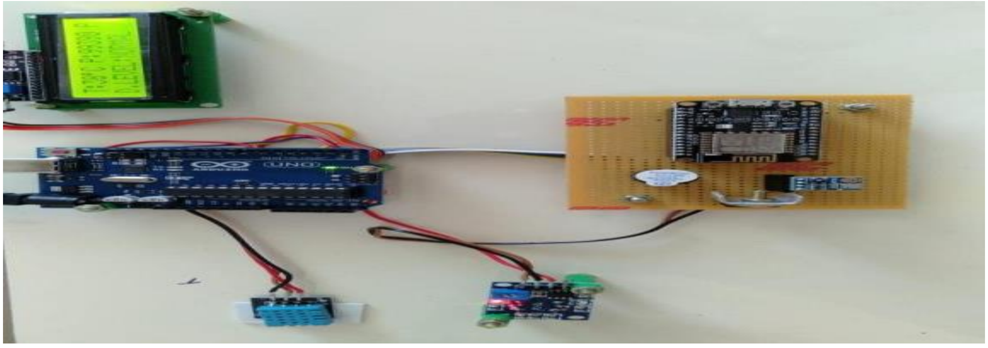

FIG-1 Device Setup

3.1 MICROCONTROLLER

Introduction

To make a complete microcomputer system only micro controller is not sufficient, it is necessary to add other peripherals such as read only memory (ROM), read / write memory (RAM), decoders, drivers, latches, number of input / output devices to make a complete microcomputer system. In addition, special purpose devices, such as interrupt controller, programmable timers, programmable I/O devices, DMA controllers, USART/UART, programmable keyboard/display drivers may be added to improve the capability, performance and flexibility of a microcomputer system. In addition battery backup and an elaborate power supply arrangement is essential. However the key feature of micro controller based computer system is that, it is possible to design a system with a great flexibility. It is possible to configure a system as large or as small system by adding or removing suitable peripherals. On the other hand, the micro controller incorporates all the features that are found in micro controller. However, it has added features to make a complete microcomputer system on its own. Therefore the micro controllers are sometimes called as single chip microcomputer. The micro controller has built-in rom, ram, parallel I/O, serial I/O, counters, interrupts and a clock oscillator circuit.

Simplified block diagram of 8051 family microcontroller

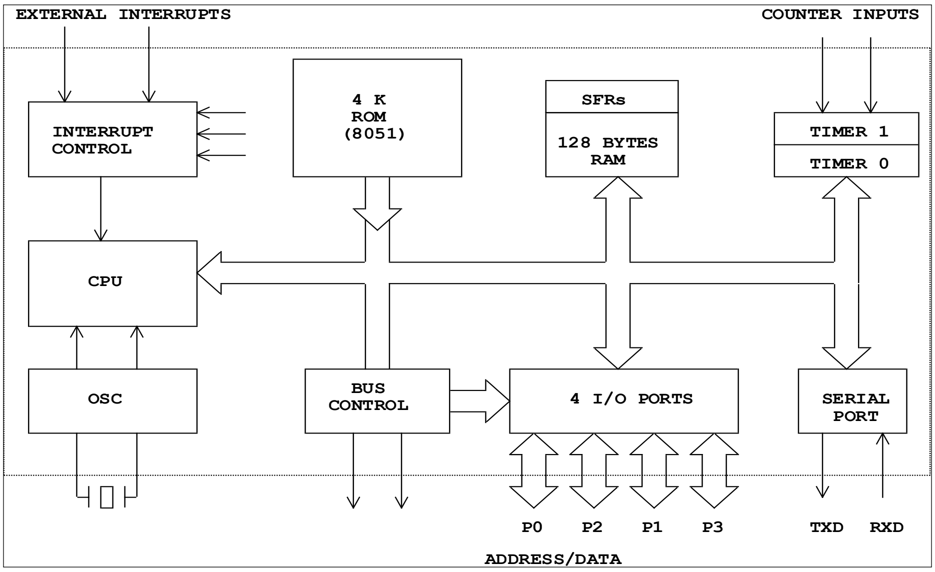

Fig-2 : Block diagram of 8051 family microcontroller

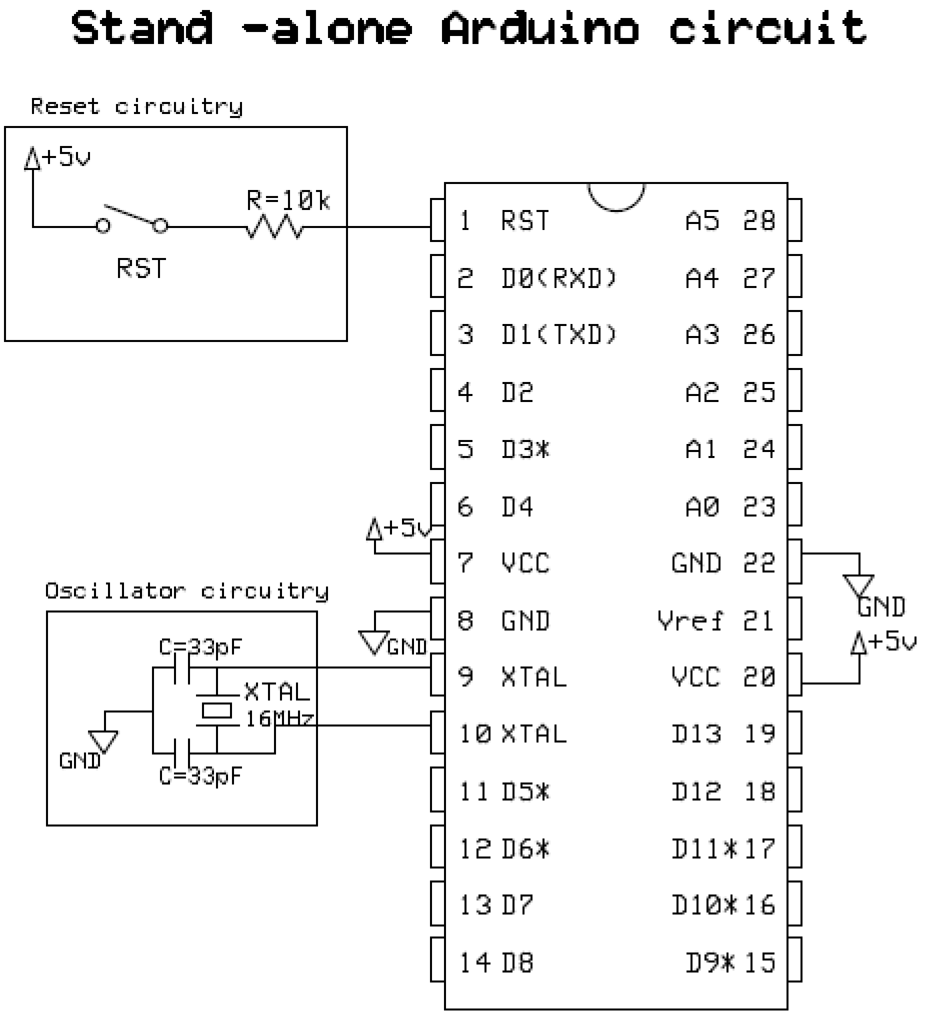

Figure 1: Stand-alone ATmega328 microcontroller

3.2 ARDUINO UNO BOARD

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few Rupees and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

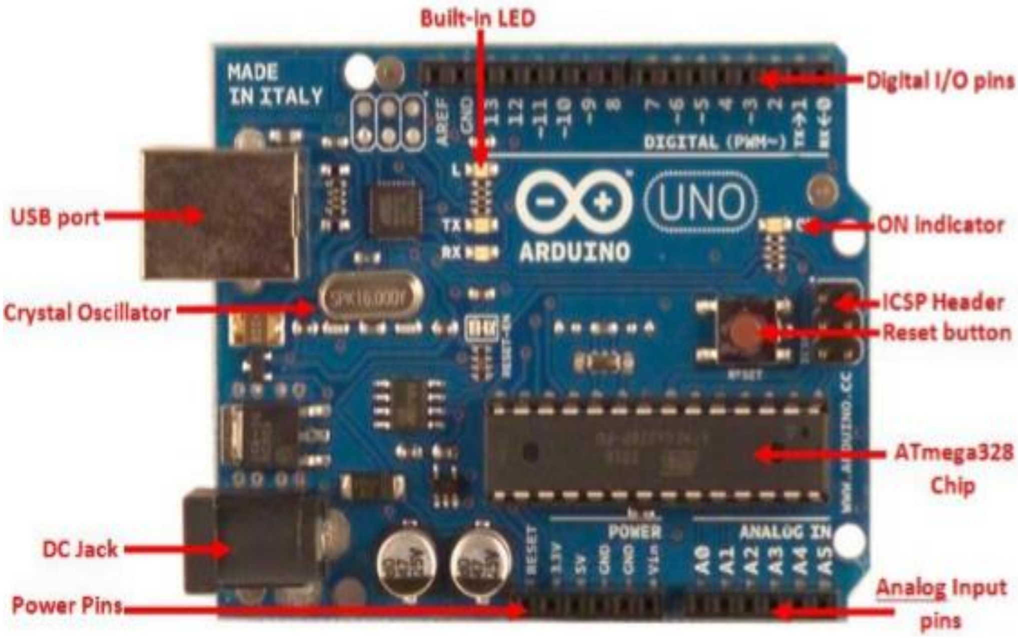

Figure-4 Uno Board Setup

3.3 GAS SENSOR (MQ-4)

1. GAS sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane.

2. When a gas/smoke interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current.

3. The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it; the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

FIG-5 Gas Sensor

3.4 REGULATED POWER SUPPLY UNIT

Definition:

A power supply (sometimes known as a regulated power supply unit or RPSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

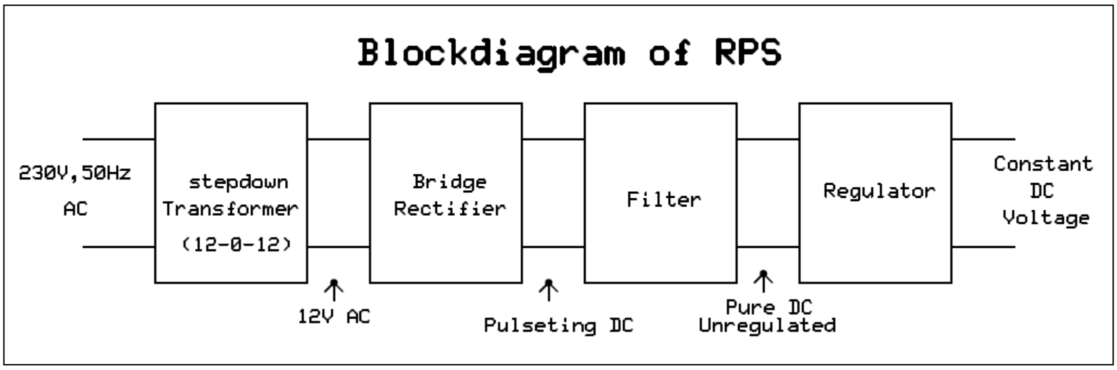

Fig-6 : Block diagram of Regulated Power supply Unit

IV. IMPLEMENTATION

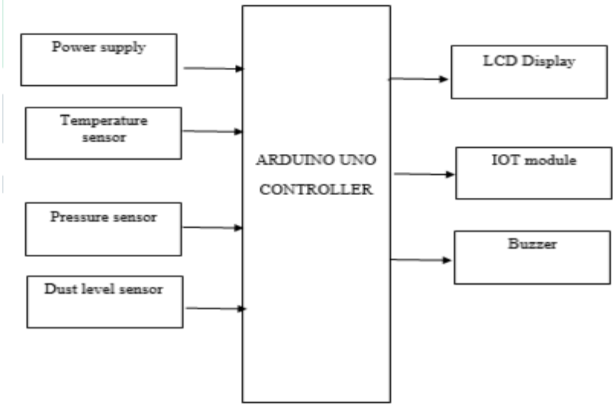

FIGURE-7-BLOCK DIAGRAM OF ASTHMA DEVICE

WORKING PRINCIPLE

This system is mainly used to monitor the health condition automatically. In this system, we use the Temperature sensor (DHT11), Pressure sensor and dust level sensor and controller, for monitoring the patient health. Any one Condition Abnormal.

HARDWARE REQUIREMENTS:

- Power Supply
- Arduino Microcontroller
- Pressure sensor
- Dust Level Senso
- Temperature sensor
- IOT Module

- LCD Display
- Buzzer

SOFTWARE REQUIREMENTS:

- Embedded C
- Arduino IDE

Workflow

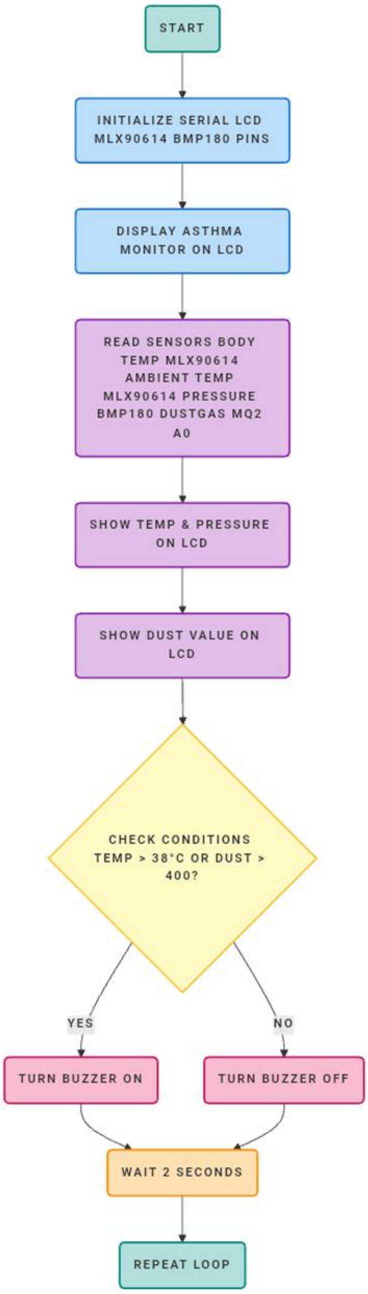

Fig-8 Workflow

V. POSSIBLE OUTCOME

The Personal Healthcare Smart Device for Asthma Patients project has the potential to significantly improve patient outcomes by reducing the frequency and severity of asthma attacks.By providing real-time monitoring and alerts, the device can empower patients to take prompt action to prevent asthma attacks, thereby improving their overall quality of life. Additionally, the device's personalized recommendations and feedback can help patients manage their condition more effectively, leading to better asthma management.The device can also enhance patient engagement by increasing patient awareness of their asthma triggers and symptoms. By providing real-time feedback and alerts, the device can educate patients on how to manage their condition more effectively. Furthermore, the device's reminders and alerts can improve patient adherence to treatment plans, leading to better health outcomes.

In terms of healthcare costs, the device has the potential to reduce hospitalizations and emergency department visits by providing real-time monitoring and alerts. By preventing asthma attacks, the device can reduce the need for hospitalizations, thereby reducing healthcare costs. Additionally, the device's remote monitoring capabilities can reduce the need for hospital visits, increasing efficiency in healthcare.The device can also provide valuable insights into patient data, enabling healthcare providers to make informed decisions about treatment. By analyzing data from the device, healthcare providers can develop personalized treatment plans that are tailored to the individual needs of each patient. This can lead to better health outcomes and improved patient satisfaction.

Overall, the Personal Healthcare Smart Device for Asthma Patients project has the potential to revolutionize asthma management by providing patients with a powerful tool to manage their condition more effectively. By improving patient outcomes, enhancing patient engagement, reducing healthcare costs, and improving healthcare provider decision-making, the device can have a significant im

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