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Smart MediBox - Patient Assisting Device

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Abstract: ***Thanks to the development of pertinent technology, IoT is rapidly advancing in the medical sector. IoMT is a group of healthcare IT systems that are linked to a variety of medical devices for various purposes. IoMT's development has had a significant influence on healthcare in general, but especially for elderly and handicapped patients. In today's fast-paced world, even regular people require assistance with daily tasks. Helping them take their meds consistently each day without skipping a dosage is one such crucial task. The data will be processed depending on dose access by this medication monitoring system. Additionally, scheduling is done based on the patient intake report's expected accessibility. The suggested system combines an improved notification system with event scheduling based on a priority method. Real-time monitoring and a reminder system are built into the Smart Medibox design to remind patients to take their medications on schedule. It includes a cooling module and sensor that are managed by a microprocessor. The alert has information on date, time, and medicine description and may be programmed for taking numerous medications. It is made to be a small, portable gadget that makes it easy to connect to a secure cloud storage for more research. The gadget transfers all of the data to cloud storage when it is Wi-Fi connected.***
Keywords: MediBox, Internet of Things (IOT), Wi-Fi, Microprocessor.

I. INTRODUCTION

The Internet of Things (IoT) is a vast network of interconnected devices and people, all of which gather and exchange information about their environments and how they are utilized. Internet of Things (IoT) is a community of bodily objects or human beings referred to as “things” that are embedded with software, electronics, network, and sensors that approves these objects to acquire and alternate data. The purpose of IoT is to lengthen to net connectivity from trendy units like computer, mobile, pill to incredibly dumb gadgets like a toaster.The workflow of an IOT system is given in the figure below.

IOT in Healthcare

With the advent of pertinent sensors and devices, the Internet of Things is making significant progress in the medical sector. IoMT is a group of healthcare IT systems that are connected to medical equipment for various uses. Healthcare for the elderly and disabled has been severely influenced by the expansion of IoMT, but not just for them. Even regular people in today's fast-paced society require assistance with their everyday tasks. One such crucial task is assisting them in making sure they consistently take their meds without skipping a dosage. The currently available medication adherence devices have several limitations, such as operating merely as a reminder system, and are limited to basic functions.

Many people, especially those who take many medications, have trouble remembering if they took their medication on time. Those who put off taking their medication at the next scheduled time face the danger of overdosing. Lack of drug administration and monitoring methods can result in under- and over-dosing, as well as many other health complications. Even while mistakes can happen at any point of the drug procedure, they frequently occur during the administration stage. MediBox is made to notify the patient at the appropriate times and with the recommended dosage. In addition to reminding a patient to take their medication, it is important tomake sure they don't consume it in a way that reduces its effectiveness.

II. LITERATURE SURVEY

This application was created using/inspiration from the following papers:

In their study "Implementation of IoT Enabled Patient Assisting Device – MediBox," Abdul Azeem K. et al., have created a healthcare system that helps people take their prescribed medications on time in order to minimize future repercussions. It does this by using IoT-enabled sensors and pertinent hardware. This paper describes the creation of a new portable device called “MEDIBOX” – an intelligent drug delivery device – as a result of the complexity and expense of more advanced systems. It is intended to assist older individuals who frequently overlook taking their meds or use the incorrect drug or amount. Additionally, it benefits those who used to travel a lot and need to take regular medicine. Therefore, we suggested a versatile, portable IoT- enabled MEDIBOX that is specifically designed to address those pressing problems.

MEDIBOX is intended to notify the patient at the appropriate intervals and with the recommended dosage. In addition to reminding a patient to take their medications, it is important to make sure that they are taken without compromising their efficacy. [1]

The purpose of T. A. Nayana et al., paper "MEDIBOX – An IoT Enabled Patient Assisting Device" is to propose a system to create MEDIBOX, a multifunctional portable intelligent gadget that aids patients in taking their prescriptions on time. This device is an efficient system that keeps variables like temperature and humidity within limits suggested by the medicine maker. In connection with this, we created a Host Management System (HMS), capable of cloud- based installation and monitoring, that maintains and manages MEDIBOX functionality for more research and any changes to design elements in the future. We suggest a little pillbox called MEDIBOX that is used to keep track of a patient's medication intake. [2]

"Intelligent medicine box for medication management using IoT", by M Srinivas et al., considers an IoT platform for modern healthcare that includes sensors for health monitoring and diagnostics coupled with an intelligent medication box. Patients and physicians may communicate more effectively with the use of an android application and an intelligent home-based medication box with wireless connectivity.

The suggested model includes an intelligent medicine box that notifies patients when it is time to take their medications. It is connected to the internet so that notifications via an Android application can provide timely updates about the medication to the patient's smartphone. If any vital signs are detected, SMS notifications are sent to the designated guardian. [3]

"An IoT Approach Toward Storage of Medicines to Develop a Smart Pill Box", by Sri Krishna Vamsi Koneru et al. discusses IoT Approach to Medicine Storage to create a small pillbox detection approach. The expiration date of the medications in the medical box is frequently overlooked. This might result in the wrong medications being taken and dangerous adverse effects. They recall the colour and size of the pills in particular, but it takes some time for them to become used to the new prescription. If the patient has ongoing health difficulties, this can be in loop. In most cases, pill boxes are set up in little boxes at specific times, and elderly individuals must physically check and take their medications. [4]

III. METHODOLOGY

The system is developed with the deep learning algorithms to perform the learning and adaptation process. Hidden Markov Model algorithm is used to analyze the captured audio signal and converted into text representation. Converted text representations are processed and the corresponding operations are identified using the deep learning model and Deep Boltzmann Algorithm and the medicine coolant system validates the box temperature and maintain it based on the contents of the box by modifying the speed of the coolant motor. Temperature decision making process is done by using the Restricted Boltzmann Machine. This model enables the system to achieve higheraccuracy levels with the following phases:

Step 1: Sensor Selection
Step 2: Interface Sensor with Arduino
Step 3: Processing the Data
Step 4: Predicting the outcome of the test
Step 5: Visualizing the results
Step 6: Verify the result's accuracy.

IV. SYSTEM MODEL

IoT is a network of physical objects that connect to and communicate with computers, including items like smart phones, automobiles, household appliances, and more. It is a cutting-edge automation and analytics system that deals with electronic, cloud messaging, networking, and artificial intelligence.

The MediBox system checks the critical level of sensed data to determine the priority of the crucial data and then generates a report that is given to the patient's doctor, career, and family members based on the assessment model. To confirm the criticalness of the patient, passive and active monitoring systems are used.

The proposed system has the following five modules:

1) Configuring interface between microcontroller and sensor.
2) Interconnection between the multiple microcontrollers and establishing synchronized communication.
3) Data collection and display current statistics.
4) Notification generation and audio synthesis circuit.
5) Applying AI and open & close control for medicine box.

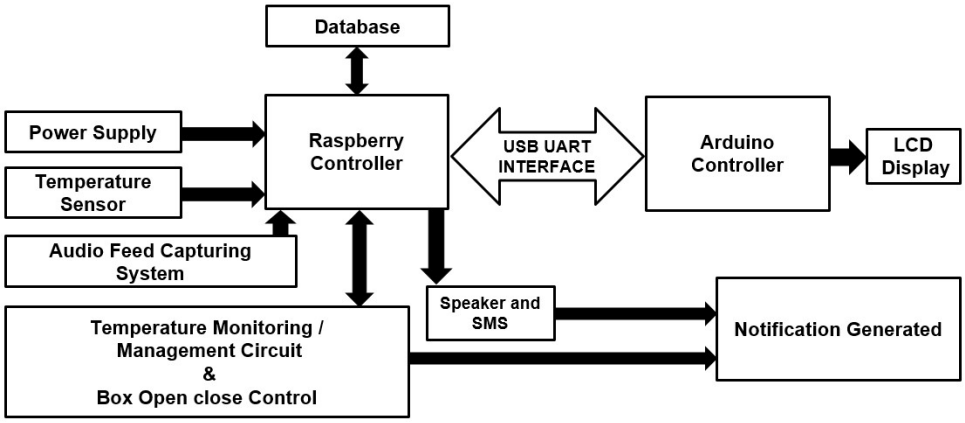

Fig 1: Workflow

A. Configuring Interface between Microcontroller and Sensor

Raspberry interface is configured with the raspbian OS using SD Card. Temperature and Humidity of the current environment are retrieved using DHT11 library and the identified values are displayed using python program.

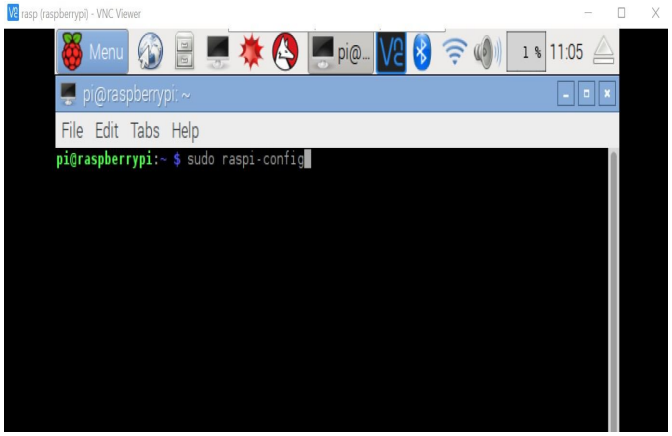

Fig 2: Configuration between microcontrollers

B. Interconnection Between The Multiple Microcontrollers And Establishing Synchronized Communication

USB-UART interface between Arduino and Raspberry pi device is configured. Corresponding USB terminal is identified in raspberry pi and used for communications. The Transmission and Reception operation is performed in both terminals. The Raspberry pi collects the data from sensor and forwards it to the Arduino. Arduino receives the data that has been forwarded by the Raspberry pi and displays it in the LCD Display.

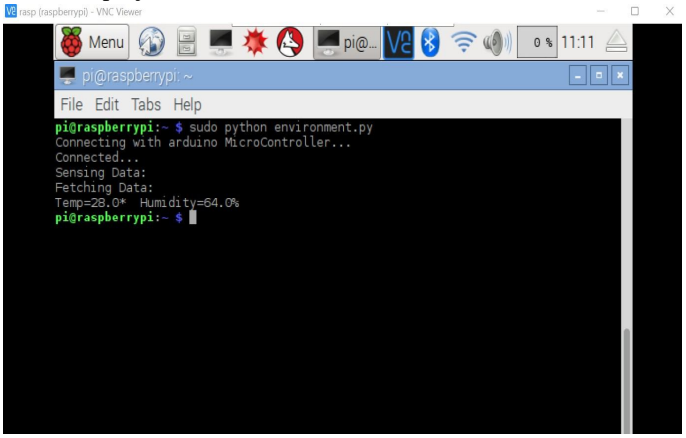

Fig 4: Fetching data from sensor

C. Data Collection And Display Current Statistics

The medicine database is created and maintained in raspberry database. The firebase interface is configured in google distributed database and connected using python. The set of medicine name and counts are stored in database and the same is synchronized with Firebase interface. The data is displayed in the LCD Display attached in Arduino.

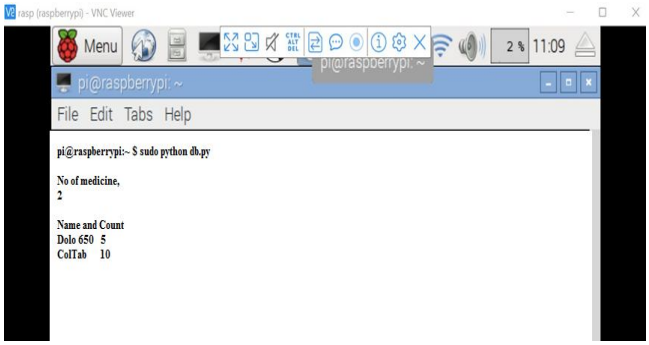

Fig 5: Displaying number, name and count of medicine

D. Notification Generation And Audio Synthesis Circuit

In this module Deep belief network is used for knowledge of time. Based on the tablet and its intake time, the notification is scheduled in the microcontroller. The notification message is transmitted using both GSM and Wireless Interface. Microphone circuit is activated to capture the audio feed from the user. Audio synthesis circuit is used to generate the voice notification.

Fig 6: Reminder Message

Fig 7: Toast Notification

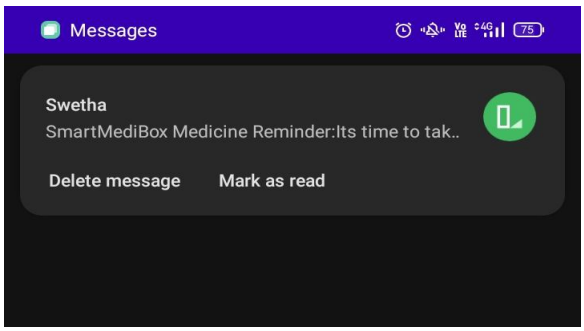

Fig 8: SMS Notification

E. Applying AI and Open & Close control for Medicine Box

The Medicine Box is designed with open and close control for each section using AI. The cooling fan system is also connected to Motor board and it is serially connected to digital pins of the Raspberry. Audio recognition is performed for box open close control.

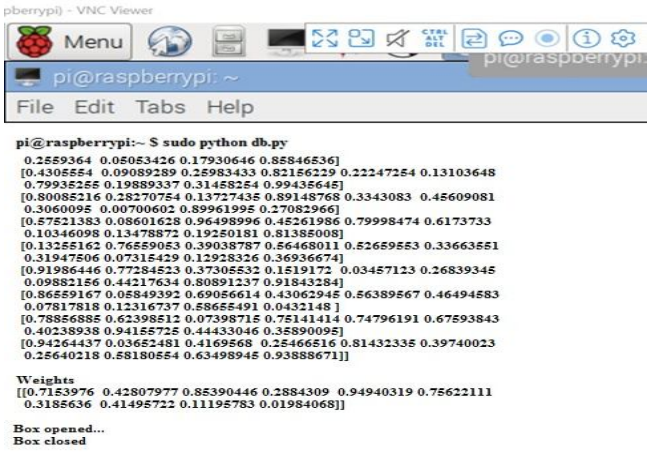

Fig 9: Weights for opening and closing of MediBox

V. CONCLUSIONS

The In conclusion, a patient can utilize this Medibox as a reminder alert to take their daily medications on time. This system is built with a user-friendly design. People today are in a difficult situation since they are too busy with their daily activities to remember when to take their medications. In this work, we present the design of Medibox, a novel medical gadget that intends to provide comprehensive patient assistance in a portable and user-friendly form. It offers a proper environment for drug storage and serves to remind the patient to take their pills. The doctor can benefit from the storage of medication intake information by having it available for future use; for example, knowing the patient's history of medication consumption will enable him to determine the effectiveness of pharmaceuticals on the patient and tailor his prescriptions appropriately. To remind people to take their medications on time, alarm systems are created. Additionally, employing the cooling system, the Deep learning-based AI approach is used to maintain the MediBox's thermal conditioning. The Deep Boltzmann Machine, which depends on the Deep Belief Networks' accounting, is the fundamental operating system for it.

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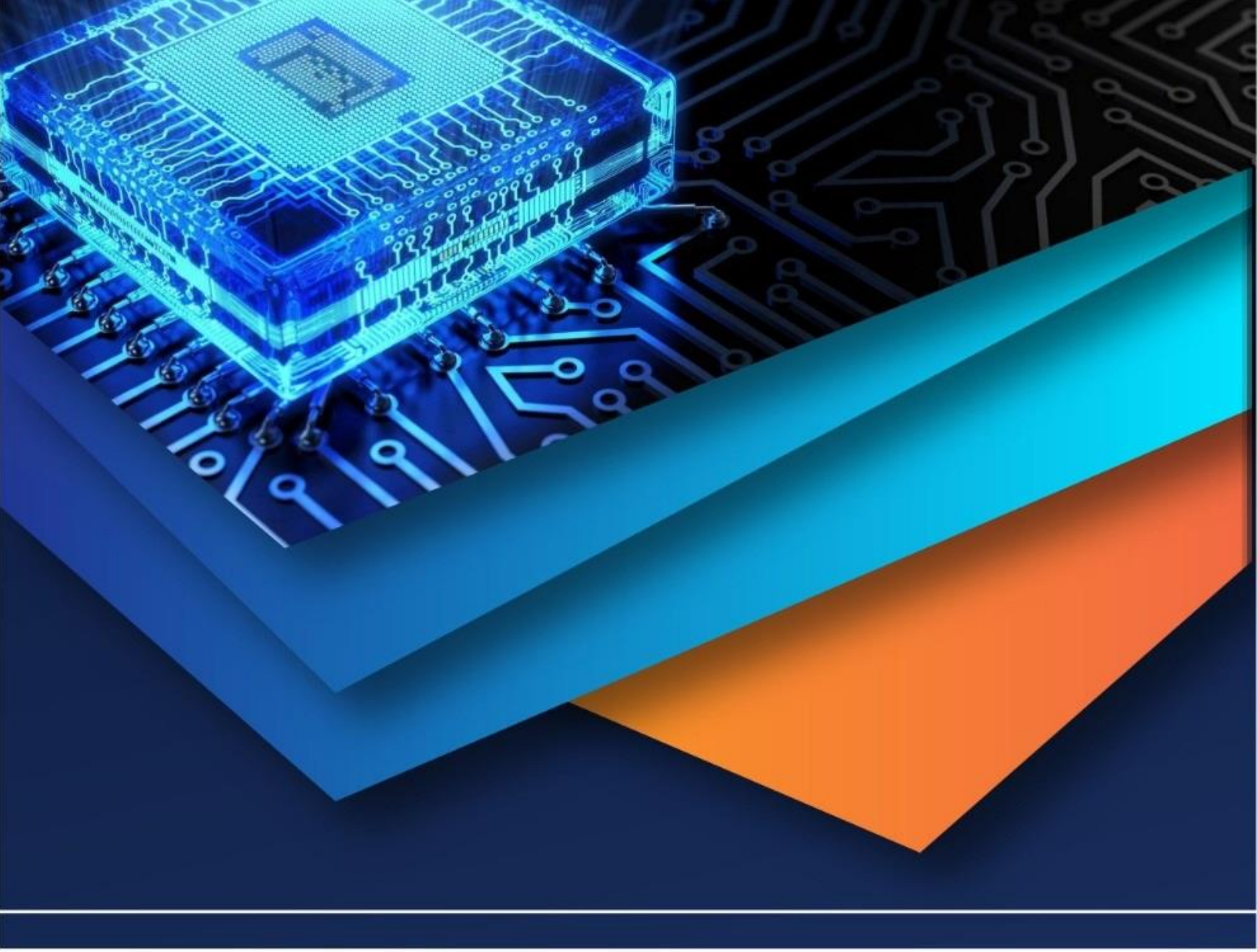

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