1.	**Project Reference Number**	46S_BE_3573
2.	**Title of the project**	SMART MEDBOX USING IOT
3.	**Name of the College & Department**	Mangalore Institute of Technology and Engineering, Badaga Mijar, Moodabidri Department of Information Science And Engineering
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6.	**Keywords**	Smart Medical Box, Medication adherence, Companion phone application, Pill scheduling, Arduino, IoT-based, Healthcare outcomes
7.	**Introduction:**	
	In the current climate of the world, most humans can be considered barely healthy due to rampant pollution, unhealthy diets and lack of exercise. This has led to nearly everyone developing a reliance on some sort of medication. This eventually leads to imbalances in the body, causing the contraction of many diseases. While not life-threatening in most cases, a few diseases are dangerous and require long-term medication to be cured. The prescriptions given by healthcare specialists are crucial in such cases and must be followed to the letter. Any changes in the prescription must also be quickly adopted by the patient.	

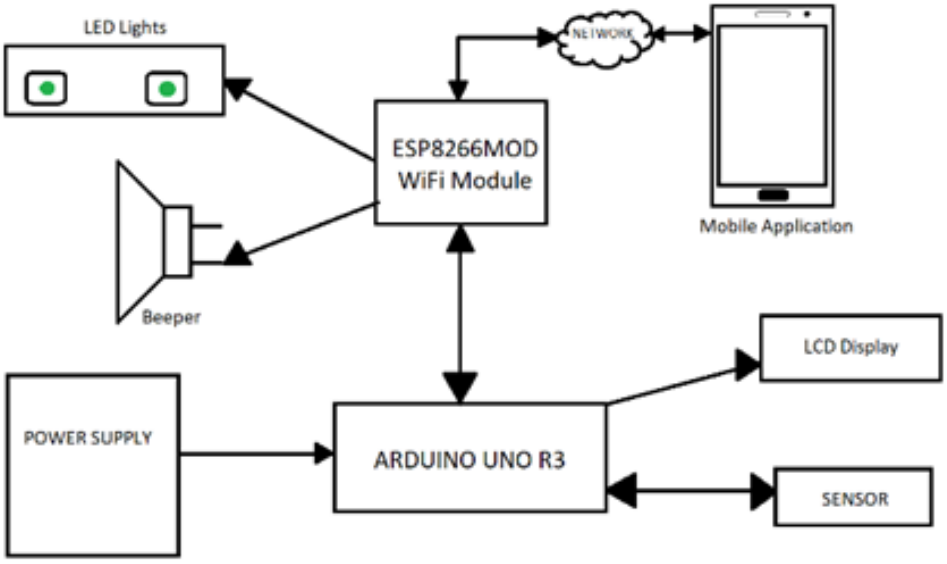
	Studies have shown that not adhering to the provided prescription is one of the major causes of the inefficacy of certain treatments. Our project proposes a Smart Medbox which uses an Arduino microcontroller in tandem with an ESP8266 Wi-Fi module to manage the timely dispensing of medication. The box itself consists of 8 slots to store different types of medication and is controlled via an Android application, wherein the medication and timings for a slot can be designated. When the specified time is reached, auditory and visual cues in the form of blinking LED lights and a buzzer respectively are provided to alert the patient. Thus the box ensures that proper medication adherence is followed. The 8-slot system of the box can be used to manage medication inventory.
8.	**Literature survey**
	Uppala, Suneetha, and B. Rama Murthy, creators of the "Smart Medicine Time Indication Box", added a keypad system to the medicine box which made the process of scheduling easier but the system still wasn't user friendly. The system would still require a basic technical knowledge to make it work properly by adding an appropriate schedule. R. Al-Shammary, D. Mousa and S. E. Esmaeili improved upon prior designs by adding a medicine dispenser to the medicine box which would detect whenever the medicine is taken from any of the compartments. This was achieved using sensors in each compartment of the box that would detect the hands of the user whenever he/she took medicine out of the compartment. But this system was inaccurate because there was no means to keep the box out of the children's hands. Daou, R. Abi Zeid, et al. added a safety lock for the medicine box and also created a mobile application dedicated to the Smart medicine box. The smart lock system would ensure that the box would remain locked until and unless the scheduled time is reached and only then the box can be opened by the user. So, by this way if anyone else tried to open the box the box would remain locked, making it inaccessible to children. The android application was made using java which was made specifically for android devices to store the user information in the system and to make scheduling more user friendly. In this app the user can schedule the medicine time in his/her android phone which makes the entire system more user friendly and make the entire scheduling process faster. The application would connect to the medicine box using Bluetooth, the medicine box would have a Bluetooth module in it which would connect to Bluetooth on the user's phone. The medicine box would send the data like notification to take medicine on the scheduled time and notify the user when the medicines are running low etc.
9.	**Objectives:**
	● The primary objective of our project is to solve the problems mentioned prior by developing and designing a tool which will aid the user in managing their pill intake in an easy and simple way. ● The system must be usable without requiring any sort of advanced training or complex operation, requiring only knowledge of operating a standard smartphone. ● Visual and auditory indicators in the form of LEDs and buzzers implemented to aid users. ● Development of a companion phone application that allows for easy operation of the system, featuring an easy-to-use interface. ● Implementations of sensors that log users' pill intake status onto the connected application.

10.	**Methodology:**

The system consists of two distinct parts: The box and the mobile application. The box houses the internal electronics, such as a NodeMCU ESP8266 wi-fi module, Arduino UNO R3 microcontroller, LCD display, sensors, buzzers and LEDs. The operation of the box is controlled via the mobile application, which is connected to the Wi-Fi module on a shared network. The operation of the box begins when data about a scheduled medication entered in the application is sent to the wi-fi module. Each instance of data consists of pill details, dosage, slot number, and the scheduled time. This data is stored internally in the Wi-Fi module, which has up to 4MB of free space for storage. A copy of the data is also sent to the Arduino board.

Once the ESP8266 is connected to the network, we initialize the NTP client and obtain the current time for the specified time zone. When the obtained time matches one of the scheduled times, the reminder functions of the system begin. The ESP8266 sends signals to the buzzer and the LED of the specified pill slot. Thus, the buzzer and the lit-up LED offer auditory and visual cues to alert the patient and indicate the pill to take. Furthermore, the Arduino board sends signals to the LCD display and also monitors the signals from the sensors within the box. The LCD display shows the name of the pill, the dosage of the pill, and the pill slot. The sensors monitor the state of the box lid. This state continues for up to a minute by default, but this limit can be changed. If the patient opens the lid of the box to take the specified pills within the time limit, the sensors signal the Arduino board that the pills have been taken. If the box is not opened, the Arduino board assumes that the pills have not been taken, and logs it into memory.

In the mobile application, users can create a schedule to be sent to the box. Operation begins when the user creates a new alarm within the app. The user then specifies the scheduled time, repeat condition and medicine details such as medicine name, slot number, and number of pills inserted. When the user saves the new alarm, the data is saved in the backend database (SQLite) and a copy of the data is sent to the wi-fi module. In this way, users can set up to 8 different pills at a time. When the specified time is reached, a notification on the users' phones reminds them of the medication. Also, as long as the phone is on the same network as the box, medication status and pill inventory details are sent to the application. Additionally, the app also allows users to monitor patients' pill intake and manage the details of any pre-existing pills.



11.	**Results and Conclusions:**
	The Smart Medbox System is simple to set up and operate and requires only minimal technical knowledge from the user. The companion mobile application features a UI that is both easy to use and accessible, and the box and the application are easy to connect together. The system is flexible enough to set up different medications at various times throughout the day, and is precise in issuing reminders. All these features deliver a system that provides a simple utility to aid anyone looking to ensure maximum effectiveness of treatment plans for themselves and their loved ones.
12.	**Scope for future work:**
	The implementation of the Smart Medbox System will go a long way in reducing one of the major concerns of the healthcare sector, that is of medication non-adherence, albeit only for the individual. Successful scaling of the system into a large network of smart medboxes connected to a central operating system is the logical next step, as such a network can be integrated into hospitals and old-age homes where they can be used to monitor the medication of patients and the elderly, respectively. Incorporating portability into the design is also a feasible objective, as is development of a more advanced medbox for use in monitoring clinical trials and research.