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Design for an automatic pill reminder and patient medication monitoring system

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Abstract: Today IoT (Internet of Thing) plays crucial role in the daily routine of human life. This technology is showing its impact in medical applications. As per reports available it id found that, health issues have become very common for people above the age of 40 and it becomes severe for elderly population. Sometimes old age people forget to take medicine and get confused when to use what type of medicine, which makes them to rely on the assistance of others. With the help of IoT, a smart device with RFID (Radio frequency Identifier), Node MCU is used in the design of this model. This system helps in suggesting the patient the kind of medicine to be taken but also it sent information to the nearby hospital in case of emergencies. Proposed model achieves an accuracy of 92%, which is very much essential in present days.

Keywords: Node MCU, RFID, Aurdino IDE, IoT.

I. INTRODUCTION

In this decade, people especially old aged individuals have a tendency to forget to consume the prescribed pills or medication at the right time. In certain occasions they completely forget to take the medicines. Most people recognized with chronic diseases are required to take medications over a prolonged period of time in order to stabilize their conditions. If they fail to intake the medicine regularly, it may lead to death. In order to live a better life, we need to take medicines regularly as prescribed. From the report of The Centers for Disease Control and Prevention (CDCP), it is estimated that the non-adherence of the medicinal intake causes 30 to 50 percent of chronic disease treatment to fail and over 125,000 deaths per year. It is also found that only 51 percent of patients taking medications for high blood pressure are supposed to continue taking their medication during their long-term treatment. To avoid such kind of deaths one has to take medicines regularly. The project is aimed to overcome the issues mentioned above and to help the people to take medicines at the right time and at regular and prescribed intervals of time. The medicinal combinations for each time of consumption (say morning, afternoon and night) are stored in separate slots. A real time clock is used to monitor the time for the consumption of medicine. At the right time of medication, the required combinations of pills are collected in a dispatch slot where the pills are ready to be taken by the desired individual. The main objective of smart medicine pill box is to remind the people mostly the elderly ones that helps them consume the medicines right on time. The pill box will also give us the information for the re filling of the box.

II. BLOCK DIAGRAM

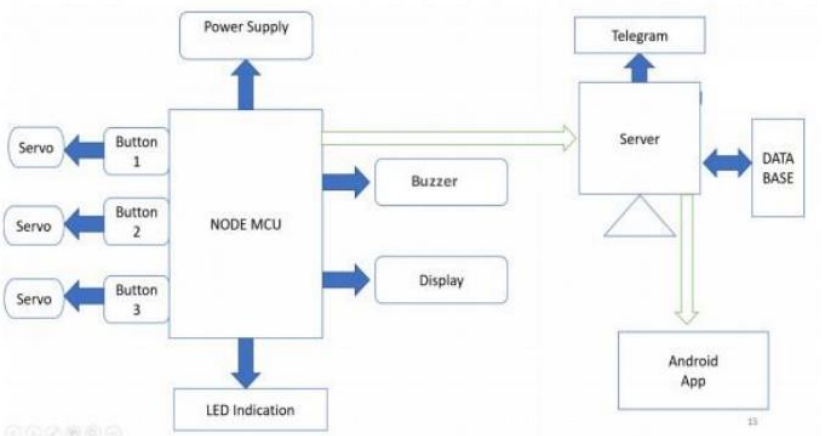

Fig. 1 Block diagram

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III. CIRCUIT DIAGRAM

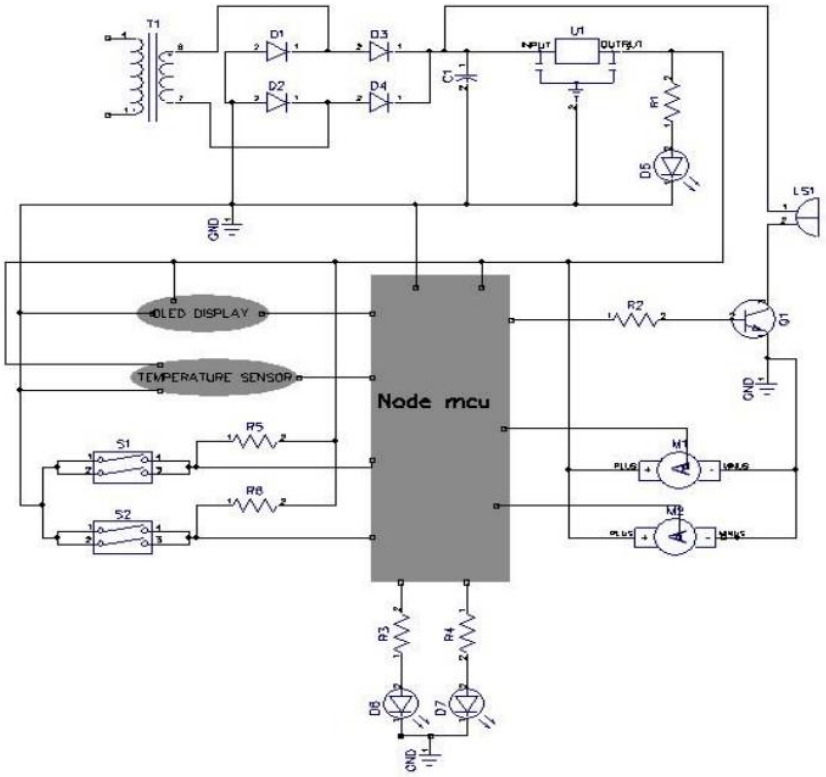

Fig. 2 Circuit diagram

Node MCU (ESP 32) is the main control unit of the project, the program code is uploaded to the Node MCU by Arduino IDE. The main power supply to the circuit is provided by a 12V AC adapter. The AC power supply is converted to DC using a Bridge rectifier (Using IN4007 Diodes) circuit, the output has some AC noise or fluctuations which is cleared by a capacitor (470 uF). In the circuit we want both 12V and 5V voltages. So, the 5V is created by using a Voltage Regulator. An LED on the circuit will be turned ON when the power is entered to the circuit. The data LED will blink when the program is running. The buzzer will alert according to the time set by the user, then a compartment which contains the medicine which is prescribed at the respective time will be open for some time, after consuming the medicine the compartment will be closed by the concerned switch, where each compartment has separate switches. If the medicine is not consumed the compartment will be closed automatically and send a message through the telegram. Servo motors are used to open/close the compartments. An OLED display is used to show the medicine name at the scheduled time, otherwise it shows 'WELCOME'

IV. HARDWARE

- Node MCU
- Servo motor
- Buzzer
- Lcd display
- Power supply
- LED

A. NodeMCU

ESP32-WROOM-32 is a powerful, generic Wi-Fi+BT+BLE MCU module which has a wide variety of applications, like low-power sensor networks, voice encoding, music streaming and MP3 decoding etc. The core of this module is the ESP32- D0WDQ6 chip which is embedded and it is designed to be scalable and adaptive. It has two CPU cores which are individually controlled. The CPU clock

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frequency ranges from 80 MHz to 240 MHz. It is advisable that the user power off the CPU and use the low-power co-processor to constantly monitor the peripherals for changes or crossing of thresholds. ESP32 has peripherals like capacitive touch sensors, Hall sensors, SD card interface, Ethernet, high-speed SPI, UART, I2S and I2C. It also integrates Bluetooth, Bluetooth LE and Wi-Fi.The sleep current of the ESP32 chip is less than 5 μA. This makes it suitable for battery powered and wearable electronics applications. ESP32 supports a data rate of up to 150 Mbps, and 20.5 dBm output power at the antenna which ensures the widest physical range. The operating system chosen for ESP32 is free RTOS with LwIP;

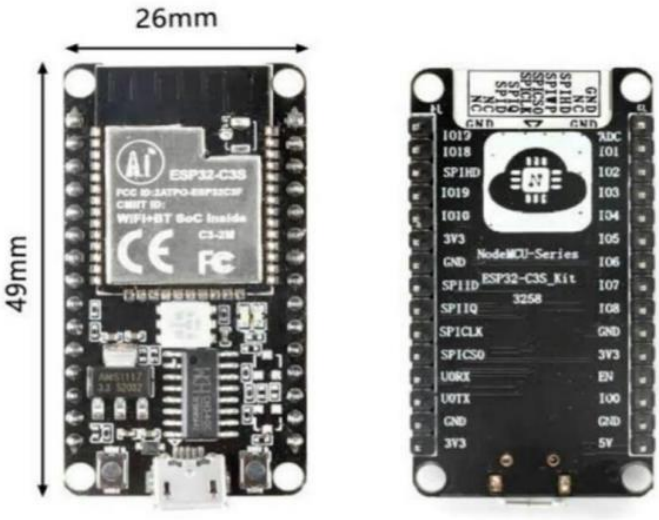

Fig. 3 NodeMCU

B. Servo motor

Fig. 4 Servo motor

A servo motor can rotate with great precision. It has a control circuit which is capable of sending feedbacksignal on the current position of the motor shaft. This allows the servo motors to rotate with great precision. If the user rotate an object at some specific angles or distance, it can be done with a servomotor. It is a simple motor which runs through a servo mechanism. A servomotor has a motor which can be either DC or AC, a potentiometer, gear assembly, and a controlling circuit. A gear assembly is used to reduce RPM and to increase torque of the motor. In the initial position of servo motor shaft, potentiometer knob is positioned such that there is no electrical signal generated at the output port of the potentiometer. If an electrical signal is given to one input terminal of the error detector amplifier and the potential difference between these two signals, which comes from the potentiometer and another comes from other sources, is processed in a feedback mechanism and output is provided in terms of error signal. This error signal is the input for motor and it starts rotating. The motor shaft is connected with the potentiometer. When the motor rotates the potentiometer and it will generate a signal. The potentiometer's angular position changes and hence its output feedback signal changes. The potentiometer will reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer and the motor stops rotating.

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C. Buzzer

A buzzer is an audio signalling device. It can be electromechanical or piezoelectric or mechanical type. It is used to convert the signal to audio sound. It is powered through DC voltage. It can be used in timers, alarm devices, printers, alarms, computers, etc. There are various designs which can generate different sounds like alarm, music, bell & siren. The pin configuration of the includes two pins, positive and negative. The positive terminal of this is represented with the '+' symbol and is powered through 6Volts whereas the negative terminal is represented with the '-'is connected to the GND terminal.

D. OLED Display

A 0.96-inch blue-yellow OLED display module is used here. It can be interfaced with microcontroller using SPI/IIC protocols. The resolution is 128x64. It is a self-light-emitting technology. A thin, multiple layered organic film placed between an anode and cathode. It does not require a backlight.

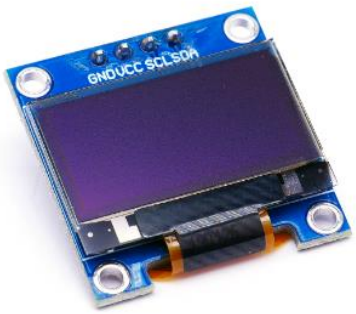

Fig. 5 OLED

E. Power supply

An AC adapter is used for external power supply. For those electrical devices which require power but do not contain internal components to derive the required voltage and power from mains power, then AC adapters are preferred . By using an external power supply allows portability of equipment so that it can be powered either by mains or battery

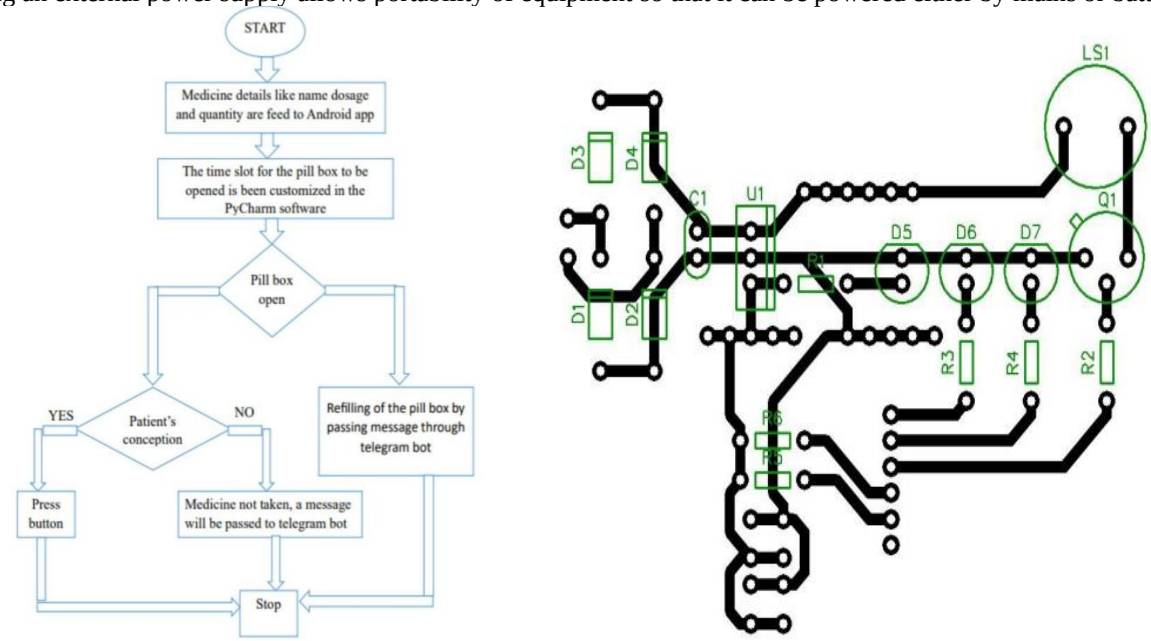

Fig. Flowchart and pcb layout

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V. RESULTS

All the objectives had been fulfilled successfully and thus the designed project would remind the patients to have their medicine on time. • By using an Arduino-based smart pill box with voice and display reminder, patients can be reminded to take their medication on time and in the correct dosage. The device can be programmed to provide customized reminders based on the patient's medication schedule, and the voice feature can provide additional auditory cues to ensure the patient does not forget to take their medication.

VI. CONCLUSION

The proposed system consists of a safety-related medical box that can alert the patient, via a phone application, about the time to take his medication and if the correct medicine dose was taken, the number of remaining pills in the box and auto-locks the box to keep the medicine out of reach of children. This system is, for sure, not the first one that helps monitoring and assisting patients. Several previous published works have proposed such systems as the design of smart homes fully equipped by sensors, the monitoring of patients' walk and fall, the telemedicine systems that monitors patients from home, added to that, as mobile phones are playing an important role in today's life, the connection of such medical systems to mobile devices is increasing dramatically due to the ease monitoring and alarm generation. As a human-related system is, the proposed safety and reliability issues are to be considered. These features must be provided mainly when transmitting data whether by making sure of the correct data delivery or the exact receiving part.

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