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E – Rural Health Companion System

Manali H Desai, Jadon J Ruzario, Affaf A Sharif, Narayan N Naik

[1]*Student, Department of Electronics and Communication Engineering, Girijabai Sail Institute of Technology Karwar, Karnataka, India.*

[2]*Assistant Professor, Department of Electronics and Communication Engineering, Girijabai Sail Institute of Technology Karwar, Karnataka, India.*

Corresponding Author: jordanruzario4@gmail.com

Abstract: - In this modern world with lot of facilities provided in the rural areas, people still face many problems due to lack of hospitals, pharmacies and transportation. To seek medical assistance, they need to travel long distances and in some cases they lose their lives during emergency situations. To overcome this problem, we are developing a health companion system for rural areas which consists of a camera module, electronic sensors interfaced with an Arduino board through which real-time parameters of the patient can be sensed and sent to the respective doctor through IOT. The doctor can remotely analyze the patient's health data and prescribe medications with the help of an android app and these medicines will be given out from the dispensing machine. This system also provides video communication feature where the doctor can consult the patient and provide medicines for timely relief and make an appointment with a specialist for the patient's further diagnosis. During emergency, alert can be sent to an ambulance and the nearest hospital to make necessary arrangements for patient's arrival.

Key Words:— ***Arduino, Diagnosis, Friendly Interface, Real-Time, Timely relief.***

I. INTRODUCTION

As technology is increasing, man power is decreasing day by day. To reduce the human efforts many electronic devices and gadgets are developed. Same thing can be said about technology advancing in medical field. Recently a technology called telemedicine was introduced. Telemedicine allows patients to contact physicians live over video for immediate care or allows captured videos/still images about patient to be sent to physicians for diagnosis and follow-up treatment later. It connects different places with health-care professionals around the world, overcoming geographical barriers. Same technology can be applied in rural areas where several people are facing health challenges and are even losing their lives due to lack of diagnosis and non-availability of medicines when needed. A system similar to telemedicine is proposed which is basically a combination of health monitoring sensors along with medicine dispensing machine. This system can prove very useful in remote areas where need of some medicine is urgent and not available, especially during night time. Health companion will help in solving these problems by providing the medicines 24x7. This proposed model will also provide pharmaceutical care to patients at distant places where they may not have physical contact with the doctor. Our system has a feature called doctor's assistance, wherein the doctor can directly see the patient and consult them and even dispense medicines remotely from another location through health companion system. Nowadays in this fast-moving world, appliances which are completely automatic are preferred; hence we have proposed this system which is completely automated.

II. RELATED WORKS

In paper [1]," Cloud Computing Based E Vending Machine for Rural Areas" has been used to provide quick access to medication. This machine stores the medicines and frequently used drugs. It is also connected to a doctor online who consults and prescribes medicines. The machine stores the medical reports and transactions related to every registered user in the clouds. Though in the above technology the doctor can suggest the patients to take prescribed medicines and treatment but they

can't assure immediate consumption of the right medicine by the patient.in case of an emergency where immediate medication is required mere consultation with a doctor doesn't help. Moreover, the medicines are reached to the patients by a time-consuming process, so it is not useful in emergency. In paper [2], "Automatic Medicine Vending Machine" provides the common medicines of the user's choice this system includes the medicines for common cold, fever, cough and band aid. It provides the medicines to the users without the prescription of a doctor this system is limited to have the medicines that can be consumed without prescription as anything else would be illegal as it requires a genuine license of a medical expert. However, these medicines do not cure if the illness is of a more serious nature. In paper [3]," Survey on Pharmaceutical Vending Machine" aims to provide the prescribed medicines to the patients on time. This system provides the facilities like ambulance facility, first aid facility, direct calling facility, smart card facility and restocking medicine alert. But it has some disadvantages i.e. it doesn't have coin sensor and APR voice

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module. So, it is difficult for illiterate people to access this vending machine. In paper [4],” Anytime medicine vending machine” fetches out the medicines automatically for the basic common symptoms for free of cost. The aim of this project is that the people to get access to drugs via patient kiosks in public places such as malls, bus stops, railway stations where the medical stores are limited This system ensures the availability of medicines 24x7.however this medicine can store a limited number of medicines which can be prescribed/consumed without doctor’s prescription. Moreover, these medicines can only be used for a timely relief and are not useful during an emergency situation. In paper [5], “Design of automated medicine vending machine using mechatronics techniques” a scanner is used to take the input from user, it includes servo motors for dispensing the medication, large storage space to store the pills, sensors to detect the motion of pills, an inventory monitoring system to keep track of the storage, an industrial standard vertical foam fill machine to pack the medication separately and a non-contact laser inkjet printer to print the description. In paper [6], "Smart medication dispenser" manages all prescribed and OTC medications of the user. It is specifically for those who take medications without close professional supervision. The smart medication dispenser is designed to prevent errors such as prescription errors, administration errors (i.e., errors due to failures to compliant to medication directions). Here they have also used a feature of medication schedule specification where it reminds the patient when some doses should be taken and adjusts the medication schedule as needed when the patient is tardy. Here the disadvantage is that the medicines are not dispensed automatically and the patient needs to retrieve the doses from the containers manually. Also, there's no record of the correct size of the dose and times of individual doses of all medications taken by the patient.

III. Proposed Methodology

The Health Companion system consists of 6 modules i.e. Health Monitoring, Medicine Dispensing, Health Companion Registration App (for Patients), Health Companion App (for Doctors), IoT Technology and Patient File Management System. The overall architecture of the proposed system is illustrated in Figure 1 It is composed of two main units, one at the patient side and the other at the doctor’s side. The unit at the patient’s side consists of heart rate sensor; body temperature sensor, blood pressure sensor, LCD (Liquid Crystal Display), camera module, Wi-Fi module, medicine dispensing machine, power supply and these are interfaced with Arduino UNO.

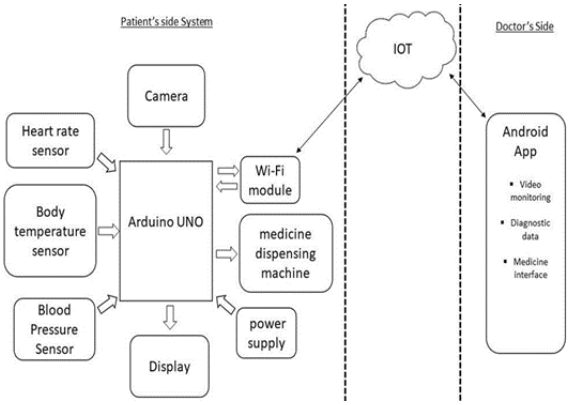

Fig.1. Block diagram of the health companion system.

The doctor’s side consists of an android app connected through IoT which provides the feature of video communication, diagnostic data and medicine interface.

IV. System Implementation

A. *Interfacing heartbeat sensor with Arduino*

Heart beat sensor is designed to give digital output of the heart beat whenever a finger is placed on it. When the heart beat detector is working, the LED flashes in sync with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow in the finger at each pulse. The sensor has a clip to insert the finger and has three pins coming out of it for connecting VCC, GND and the Data. In order to display the heartbeat readings in bpm, we have to connect a 16×2 LCD Display to the Arduino UNO.

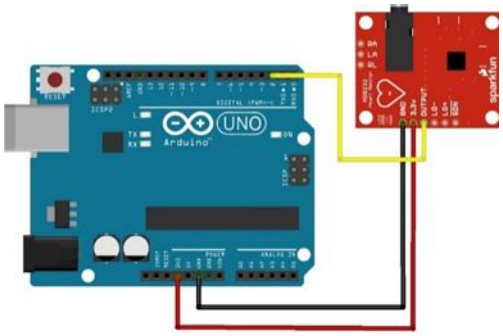

Fig.2. Interfacing of heart beat sensor with Arduino.

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B. Interfacing temperature sensor with Arduino

In the proposed system we have used LM35 sensor to measure the temperature. The LM35 IC has 3 pins; 2 for the power supply and one for the analog output. It is a low voltage IC which uses approximately +5VDC of power. The output pin provides an analog voltage output that is linearly proportional to the Celsius (centigrade) temperature. Pin 2 gives an output of 1 millivolt per 0.1°C (10mV per degree). So to get the degree value in Celsius, all that must be done is to take the voltage output and divide it by 10.

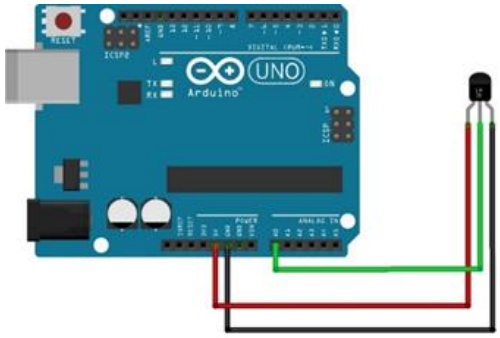

Fig.3. Interfacing of temperature sensor with Arduino.

C. Interfacing pressure sensor with Arduino

Blood pressure is recorded as two numbers-the systolic pressure over the diastolic pressure. The measurement is written one above or before the other, with the systolic number on top and the diastolic number on the bottom. For example, a blood pressure measurement of 120/80 mmHg expressed verbally as "120 over 80".

Fig.4. Interfacing of blood pressure sensor with Arduino.

In this system we are not using full Sphygmomanometer, only the half part and the remaining electronic parts which create the analog O/p as per the increase in pressure. Here we have used a Barometric pressure sensor [BMP 180].

D. Interfacing servomotor with Arduino

Servo motor is a closed-loop system which uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal. So, the main task of mechanism is to maintain output of a system at desired value at presence of noises. The motor is paired with an encoderto provide speed and position feedback, but only the position is measured. This measured position of the output is compared to the command position which is external input to the controller. Interfacing of the servo motors in this system is to provide the rotation mechanism in order to get the required tablets out.

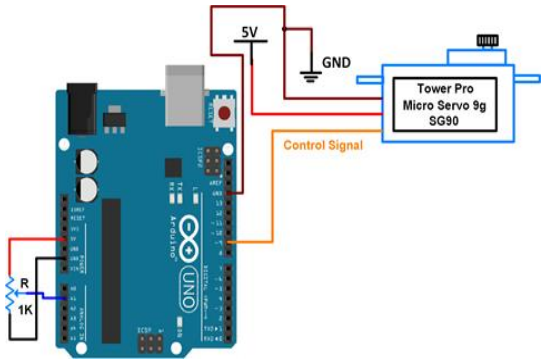

Fig.5. Interfacing of servo motor with Arduino.

E. Interfacing ESP-32 Cam with Arduino

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides onboard TF card slot. In our project we have used this module for both camera purpose as well as for Wi-Fi connectivity to connect our system to the cloud.

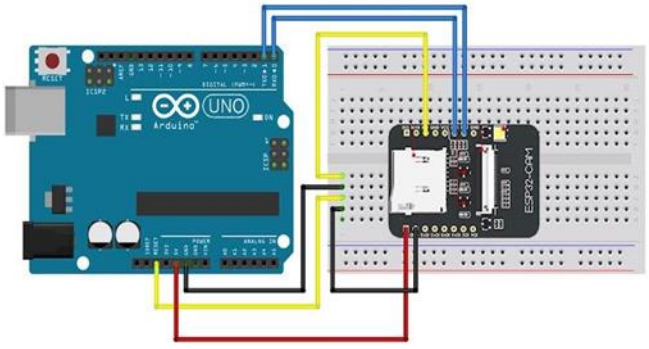

Fig.6. Interfacing of ESP-32 CAM with Arduino.

F. Firebase Real-time Database

The Firebase Real-time Database is a cloud-hosted NoSQL database that enables data to be stored and synced between users in real time. Here data is stored as JSON and synchronized in real-time to every connected client. We have used this platform for prototyping our project by connecting

Arduino Uno and our android app to the same database and programmed them such that both Arduino and the application can write and retrieve data at the same time.

G. Android Studio IDE

Android Studio IDE is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems.

V. Results And Discussion

Our proposed system is working as per our requirement. All the components are functioning correctly. The sensors are giving nearly accurate readings. The QR code scanner is scanning the id and giving the correct details of the patient and automatic file creation in database is also working. The health parameters are displayed on the health companion app and also the Medicines can be dispensed successfully using the same

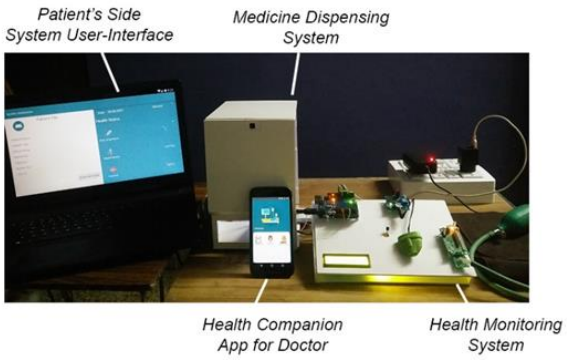

Fig.7. E - Rural Health Companion Setup

Fig. 7 shows the E – Rural Health Companion setup. It mainly consists of the health monitoring system; which has the health monitoring sensors such as temperature sensor, heart rate sensor and blood pressure sensor, an LCD display, a camera module for video monitoring purpose and a Wi-Fi module for internet connectivity. All these components are interfaced with an Arduino Uno. There is a medicine dispensing machine which dispenses the medicines prescribed by the doctor. It has been designed using servo motors for medicine storage and delivery. The health companion app for the doctor will provide the feature of patient health data, video monitoring and medicine interface.

VI. Conclusion And Future Scope

The proposed prototype of "E Rural Health Companion System" is designed and implemented successfully. This system will help in reducing the health care costs in rural areas by reducing travel expenditures. The device may be upgraded by adding more sensors with the proposed system described above. Its functionality can be increased to measure many other health parameters of human being like Blood Tests for Blood Sugar, Urine Test etc. And can be made more advance to provide more accessibility. Thus, it makes it less time consuming and very efficient digital monitoring.

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