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Cloud Computing based E-Vending Machine for Rural Areas

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Abstract: *The Indian government is trying to deal with the problem of underdeveloped Rural Hospitals, as these places are in drastic need of health care, doctors and medicines. Often there is no quick access to medication. The concept of an "E-vending machine" has been proposed to solve this ever evolving issue. This machine stores essential and frequently used drugs. It is also connected online to a doctor, on call, who consults and prescribes the medicines, which is dropped to user, like money is dropped from an ATM (Automated Teller Machine). The machine stores medical reports and transactions related to every registered user based upon the parameters obtained by using sensors such as temperature, respiration and heartbeat interfaced with a microcontroller. Thus by avoiding the expenditure spent on physical components to store the data. Instead they are stored on multiple virtual servers*

Introduction

1.1. Telemedicine

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 at a later time. Telecommunication technologies are found to be effective tools for connecting remote sites. By opening up new channels for communication, telemedicine connects rural and remote sites with health-care professionals around the world, overcoming geographical barriers. This can lead to increased communication between health service facilities, and facilitate cross-site and inter-country collaboration and networking. Telemedicine promises improved outcomes and enhanced life quality for patients; facilitate easier and more regular contact between patients and care providers by reducing the need for in-person consultation; and it can reduce the national cost of health care by reducing unnecessary tests, in- person visits and patient transfers. Through the above technology the doctor can suggest the patients to take prescribed medicine and treatment but he cannot assure immediate consumption of the right medicines by the patients. In case of emergencies, where immediate medication is required, mere consultation with a doctor does not help. Hence availability of medicines to patients serves a great purpose.

1.2. Telepharmacy

Telepharmacy is another developing technology for giving pharmaceutical care to patients at distant places where they may not have physical contact with pharmacists. It includes drug therapy monitoring, refill authorization, patient counselling, prior authorization, monitoring formulary compliance with the aid of teleconferencing or videoconferencing. A telepharmacy dispenses medicine to the patient after the prescription of the patient has been processed by a registered pharmacist from home or from another location. The disadvantage of telepharmacy is that the medicines are reached to the patients by a time consuming process, so it is not useful in emergency.

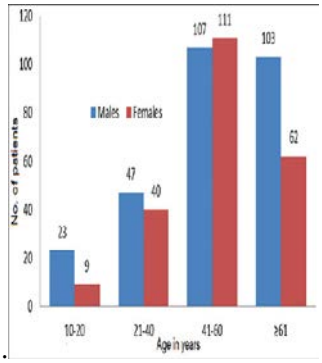

Figure 1.1. Old aged patients in hospital for regular check-ups.

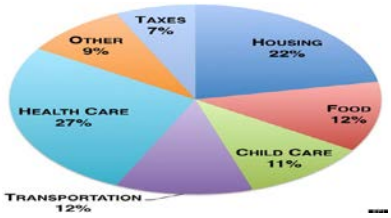

Figure 1.2. Monthly expenditure of a layman

2. Related Works

2.1. Assistive system for remote accident patients

[G Umashankar, G Hari Krishnan, R J Hemalatha, Sheeba Abraham, and Sindu Divakaran,"Research Journal of Pharmaceutical, Biological and Chemical Sciences Assistive System for Remote Accident Patients(RJPBCS)",ISSN: 0975-858,September – October2014]

Sensors like Temperature and Heart rate sensors were been used to find the basic parameters like temperature and heart rate in our project we are using LM 35 and Photo diode were used. Camera serves two purposes. One, it recognizes the user who has logged in using face recognition techniques and two, it is used to communicate with Doctor through Video conferencing. To communicate with the doctor, we need microphone to speak and speaker to hear the voice of Doctor and also to know about the AMM alerts. This reads the user's unique finger print by reading them. New users are requested to give their finger prints for secured and authenticated login for future use. Medicine dispenser gives out the prescribed medicine through the door after the payment has been made using swipe card with authentication.

It is a place where medicines are kept safely to protect the medicines from external activities such as robbery, weather changes, etc. Medicines are kept inside the cartridge. This is kept inside a vault where others cannot access it without permission of the admin. Medicines are provided to patient from this cartridge through medicine dispenser as money is given to the ATM user. The user will login with the user ID and the password given. After logging in, the and the finger print is recognized by the sensor and this information of the user is stored in the virtual servers using cloud computing technology, the initial display of the AMM will have the options such as new user, login, more info, first Aid and help. If it is a new user then the face and the finger print is captured and stored in the database. A random user ID and password will be generated for the new user and it will be given through printed paper by the printer. Then the user can login with new user ID and password. If he is an old user then he can log in using his username and password, which exist already. In case if an existing user forgets his user id and password, he can login and give his face and finger print and a search is made in the database. Referring Figure 2.1, If the face recognition and finger print biometric matches, then the user ID and password, which already exists will be given to the user for login. The user can call a Doctor by choosing "call a doctor" option in touch screen to communicate with Doctor through video conferencing for prescription.

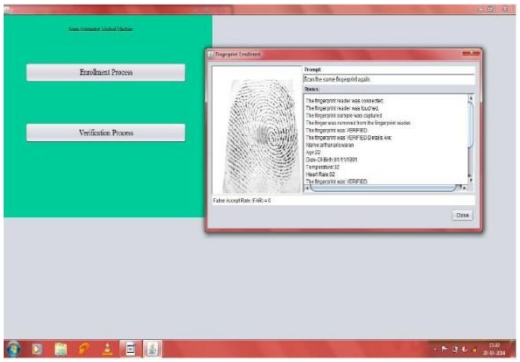

Figure 2.1. Initial Patient Monitoring System

2.2. ATM based automated medical machine (AMM)

[V. Ramesh Kumar, P. Lenin , S. VimalRaj,"AMM", IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 01, 2015 | ISSN (online): 2321-0613]

AMM has designed a new system which is similar to an ATM machine where any person can consult any doctor at any time through real time server. This paper is developed to provide medical services particularly for the rural and urban areas where, the medical facilities are not easily available. Automated Medical Machine (AMM) consists of Biomedical sensors, Radio Frequency Identifier (RFID) reader, PC with web camera, Medicine dispatcher Heartbeat, Body temperature, Height, Weight using appropriate sensors after swiping the RFID (Radio Frequency Identifier) card of the person in the smart card reader which is interfaced to microcontroller(Refer Figure 2.2). After checking, the money for the particular test is debited from their bank account. This concept will be useful for the business people who were in long journey, and for rural people. This technique does not require doctor help in the clinics. So it is not necessary to wait for the doctor to provide treatment for the patient. This technique will be widely used in the future.

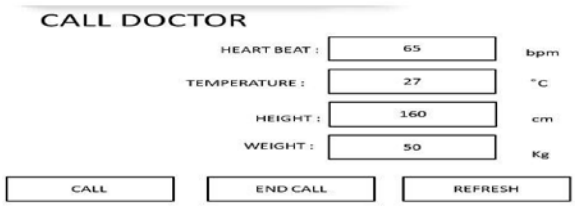

Figure 2.2. Result of Different Parameters

2.3. Automatic medicine vending machine

[Shrikant Bhange, Kaveri Niphade, Tejshri Pachorkar, Akshay pansare, International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 3, March 2015]

Degrees of social status are closely linked to health inequalities. Those with poor health tend to fall into poverty and the poor tend to have poor health. According to the World Health Organization, within countries those of lower social economic strata have the worst health outcomes. Health also appears to have a strong social component linking it to education and access to information. In terms of health, poverty includes low income, low education, social exclusion and environmental decay. The poor within most countries are trapped in a cycle in which poverty breeds ill health and ill health breeds poverty. Any Time Medicine Vending Machine is although not a new concept in its entirety, it could prove to be useful and hence important in developing countries like India where healthcare is almost critical. The automatic medicine vending machine is technically feasible to the people. It is based in PIC micro-controller provide GSM service. It gives availability of medicines all the time, also in rural areas. It is very helpful. It gives ease of access also. It is sales person-less service which is based on smart card.

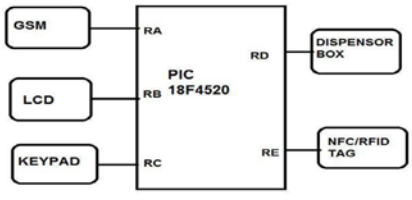

Figure 2.3. Medicine vending machine

3. Motivation

The World Health Organization reported that one third of the world's population lacks reliable access to required medicines. Only 25% of the health facilities are available for use to 75% population in towns and rural regions. Many people suffer due to lack of medical facilities and also due to negligence of untrained hospital staffs. Referring Figure 1.1 and 1.2, Appointments must be booked in advance to consult a Physician and the amount spent by a patient includes the money that is to be paid as salary to nurses and other workers in the hospital. The availability of common medicines is scarce in many places of world. Pharmacies are severely overcrowded and service is more often of less quality than required than. We often see queues that run a mile long, at government hospitals that are filled with people waiting to get their required medication. Medical shops, dispensaries and pharmacies are mostly closed at midnight and holidays, so during emergency situations, immediate access to supplies may prove to be a major difficulty, and at times, even impossible. Inadequate distribution of medicines also affects the availability of medicines.

To overcome all these problems in acquiring medicines with doctor's prescription through interactivity we come up with a solution called "AMM-Automated medical Machine enabling enhanced features of telemedicine using Cloud Computing". It reduces the cost of visiting a Doctor in hospital/clinic at distant place. It provides immediate access to doctors, who are connected with the AMM and also a quick delivery of medicines to the patient's hand using a swipe card.

4. Overview of E-Vending machine

The basic parameters like Heartbeat Rate, Temperature, and Breath count has been measured which are very necessary if any patient attempts for primary medication. These parameters has been measured using sensors interfaced with microcontroller on the patient side. The sensors which has been used were highly sensitive and low cost.LM35 is the sensor which we used for measuring temperature, by touching that sensor it displays the temperature reading in degree celsius .Heartbeat Rate is measured through IR sensor by transmittance type. Once finger is placed in between the two photo sensors the heart beat rate is displayed in LCD and the heart rate for one minute has been calculated by considering for each 20 sec pulse count i.e., the heart rate for 20 sec is multiplied by 3. By using respiration sensor the breath count can be calculated for the patient which is measured through a condenser microphone. Once the sensor values has been measured, the patient's RFID tag has been sensed by the RFID reader, the corresponding result obtained from the sensors has been updated to the doctor through web server by using java platform (jdkNetbeans 8.0.2).A simple mechanical setup with 3 gear motors and 3 storage pipes has been designed for medicine storage &

delivery. We used JAVA platform for patient's detail access and for medicine delivery. SKYPE is provoked with java for achieving video conferencing. By pressing CALL SKYPE option, the call will be forwarded to all the Doctors available and it can be attended by anyone who is able to consult the patient. Once patient consults with doctor through the SKYPE, medicines will be delivered as per doctor's instruction to the patient.

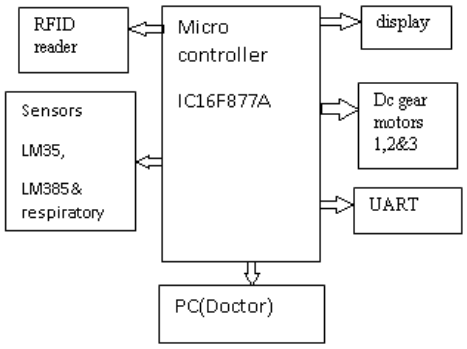

Figure 4.1. Block diagram of automated medicine dispensing machine

4.1. Hardware and software components used

➢ **TRANSMITTER SIDE**

- Power Supply
- Microcontroller
- RFID Reader and Tag
- Heart beat Sensor
- Temperature Sensor
- Respiration Sensor
- LCD
- Motor Driver Circuit
- Medicine Dispensing System

➢ **RECEIVER SIDE**

- UART
- Personal Computer

4.2. Description of components

4.2.1. Power supply (IC7805)

It is obvious that no electronic circuit works without power supply. Power supply is a device that supplies electric power to electrical load. The voltage range available in every house is 230V AC supply. This voltage range has to be converted to a range that can be used for the operation of microcontroller. So we are using a step down transformer which will convert the 230V AC supply on primary side of transformer to 12V AC on the secondary side. The alternating current has to be rectified to unidirectional current. This process is done by abridge rectifier the rectified output is a 12V unidirectional current. This is to be converted to a DC current which will filter the alternating current to a direct component i.e. a 12V DC. This is given as input to a voltage regulator IC7805. The output from the IC is +5V DC.

4.2.2. RFID

Radio Frequency Identification (RFID) is a communication technology which allows for defining some unique characteristics of an object or a living being, usually its identification information, by relating it to a numeric serial number within a tag, and ensures that this number is conveyed by using radio waves. RFID provides a communication infrastructure at the radio frequencies between a special tag and reader device that can detect the tag, and allows for establishing communication between devices within the system without any physical contact, or even without seeing each other. In this system, the RFID tag stores individual information of the patient and an RFID reader communicates with the tag in radio frequencies to identify the patient. After the information of patients has been recorded, and the relevant doctor who is assigned to the patients can read the personal details of the patient reach the server and withdraw relevant health information from database and submit them to the doctor.

4.2.3. Sensors

4.2.3.1 Temperature sensor (LM35)

The body temperature of the patient has to be measured to send it to the Doctor. In this purpose LM35 has been used. Referring Figure 4.2, it has 3 terminals which gives an output voltage proportional to the body temperature. 5VDC supply has been given to pin number 1 of LM35. The output from pin 2 will give the voltage proportional to temperature .A 10K ohm variable resistor is used at the output from LM35.This variable resistor acts like a calibration. The calibration of the output voltage is done by measuring the body temperature by using normal thermometer and its equivalent voltage. The same voltage has to be generated at the output of LM35.The variable resistor acts like a voltage divider when its resistance is varied.

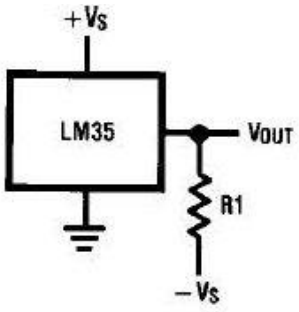

Figure 4.2. Temperature sensor circuit

4.2.3.2. Heartbeat rate sensor

The heartbeat of the patient is detected using an IR LED and LDR combination. The red high intensity light emitted by LED initially falls on LDR.
This is the condition where the heartbeat is calibrated to zero using a resistor. When a patient places their finger in between LED and LDR. The light is restricted by the finger. The intensity of light penetration decreases if the blood is pumped into the finger. If the blood is not pumped then the light intensity is high. This high and low light intensity helps to measure heartbeat. Actually light falling on LDR cuts due to blood movement. The duration of each heartbeat pulse, inverse of this time gives the time duration of each heartbeat count per minute. This signal is amplified in two stages using two LM358 ICs. It will amplify the input signal having high feedback resistance to produce high gain. The second amplifier is a comparator which is used to compare the available voltage with the reference voltage.

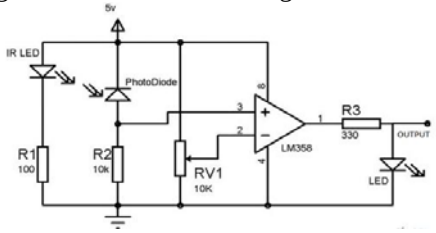

Figure 4.3. Heartbeat Rate Sensor Circuit

4.2.3.3. Respiration sensor

Respiration sensor consists of condenser microphone and transistorBC547.The patient wears oxygen mask with contains the above module. When the patients exhales , the voltage in the condenser microphone changes and this voltage is amplified by the transistor BC547.In this way the breath count is generated. The normal count for an adult at rest is 12-20 breath per minute. Figure 4.3 shows the Respiration sensor Circuit.

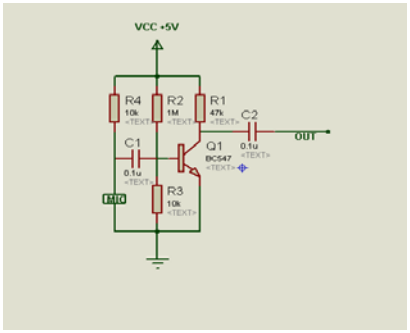

Figure 4.3. Respiration Sensor Circuit

4.2.4 Microcontroller (PIC16F877A)

IC PIC 16F877A is an 8-bit microcontroller 8K x 14 bit flash program memory,368 bytes of RAM Extra peripherals like ADC, USART, timers, compare capture and pulse-width modulation modules, and analog comparators.

It is based on the reduced instruction set computer (RISC) architecture. The microcontroller processes the sensor output to compute the temperature in degree Celsius. The internal ADC of the microcontroller is used to convert the analog output of the sensor into its digital equivalent value. The channels of analog inputs and gives 10-bit digital output. The above described sensor values has been interfaced with the microcontroller at the ADC ports of the microcontroller and these values are displayed on the LCD(16X2) by interfacing the microcontroller with the LCD.

4.2.5 LCD module

A 16 x 2 LCD is used for displaying the temperature, heartbeat and respiration count. Figure 4.5 represents the interface of LCD module withPIC16F877A. The control lines EN, R/W, and RS of the LCD module are connected to pins RB3, Ground and RB2 of Port B of Port B of the microcontroller respectively. Table 4.1 shows the truth table of 16x2 LCD. The commands and data to be displayed are sent to the LCD module in the nibble mode from Port B of the microcontroller. The higher four bits of the LCD (D4 through D7) are connected to the higher nibble of Port B(RB4 through RB7).

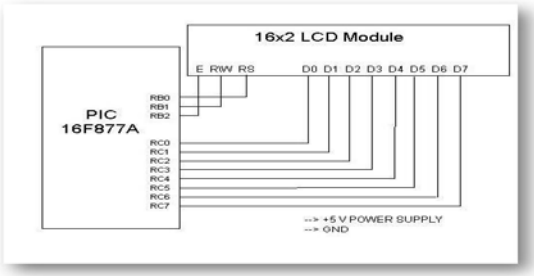

Figure 4.5 LCD module interfaced with PIC microcontroller

Table 4.1. Truth Table of 16X2 LCD

DIGIT	HEX Value	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0
		D0	D1	D2	D3	D4	D5	D6	D7
		8	4	2	1	8	4	2	1
0	0x03	0	0	0	0	0	0	1	1
1	0x9F	1	0	0	1	1	1	1	1
2	0x25	0	0	1	0	0	1	0	1
3	0x0D	0	0	0	0	1	1	0	1
4	0x99	1	0	0	1	1	0	0	1
5	0x49	0	1	0	0	1	0	0	1
6	0x41	0	1	0	0	0	0	0	1
7	0x1F	0	0	0	1	1	1	1	1
8	0x01	0	0	0	0	0	0	0	1
9	0x09	0	0	0	0	1	0	0	1
		a	b	c	d	e	f	g	dot

4.2. Medicine dispensing system

The mechanical setup of the medicine dispenser is connected to 3 rotating motors and the medicine is dispensed based on the command which is given by the doctor depending on the sensor values of the patients. One of the 3 motors will be rotating and the medicine will be dispensed to the registered user.

4.2.1. Motor diver circuit (L293D)

Figure 4.6 circuit uses L293D IC which requires 3 inputs to operate and enable a driver and 2 inputs to a motor. ENABLE is given to pin 18 and inputs to pin 2 and 7. Depending on 1 and 0 to IN1 and IN2 the motor will rotate in LEFT or RIGHT direction.

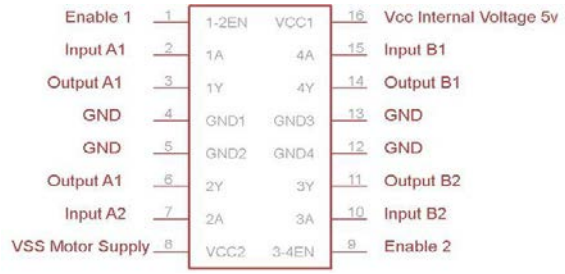

Figure 4.6. shows the pin diagram of L293D.

4.2.2. Software components

➢ **MPLAB:**

MPLAB is a free integrated development environment for the development of embedded applications on PIC and ds PIC microcontrollers, and is developed by Microchip Technology. MPLAB X is the latest edition of MPLAB, and is developed on the NetBeans platform. MPLAB and MPLAB X support project management, code editing, debugging and programming of Microchip 8-bit, 16-bitand 32-bit PIC microcontrollers.

➢ **Proteus**

The **Proteus Design Suite** is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB Layout modules. It is developed in Yorkshire, England by Lab center Electronics Ltd with offices in North America and several overseas sales channels. The software runs on the Windows operating system and is available in English, French, Spanish and Chinese Languages.

➢ **NetBeans**

NetBeans IDE is an open-source integrated development environment. NetBeans.IDE supports development of all Java application types (Java SE(including JavaFX), Java ME, web, EJB and mobile applications) out of the box. We used NetBeans 8.0.2 platform for developing JAVA.

4.3. Implementation and working

In this proposal the basic parameters like Heartbeat Rate, Temperature, and Breath count has been measured using the AMDM shown in Figure 4.7 which are very necessary if any patient attempts for primary medication. These parameters have been measured using sensors interfaced with microcontroller on the patient side.

Figure 4.7. E-vending machine

The sensors which have been used were highly sensitive and low cost. LM35 is the sensor which we used for measuring temperature, by touching that sensor it displays the temperature reading in degree Celsius .Heartbeat Rate is measured through IR sensor by transmittance type.Once finger is placed in between the two photo sensors the heart beat rate is displayed in LCD and the heart rate for one minute has been calculated by considering for each 20 sec pulse count i.e., the heart rate for 20 sec is multiplied by 3. By using respiration sensor the breath count can be calculated for the patient which is measured through a condenser microphone. Once the sensor values has been measured, the patient's RFID tag has been sensed by the RFID reader shown in Figure 4.8.

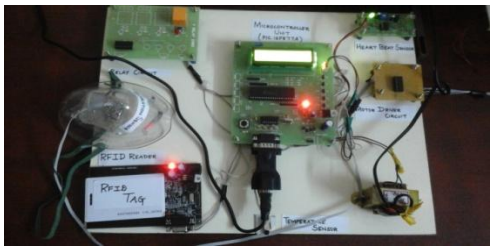

Figure 4.8. Microcontroller Unit Interfaced With Sensors, RFID.

4.3.1. Motor Driver Circuit

The corresponding result obtained from the sensors has been updated to the doctor through web server by using java platform (jdkNetbeans 8.0.2). We used JAVA platform for patient's detail access and for medicine delivery. The output of the web server page is shown in Figure 4.8.
SKYPE is provoked with java for achieving video conferencing .By pressing CALL SKYPE option, the call will be forwarded to all the Doctors available and it can be attended by anyone who is able to consult the patient. Once patient consults with doctor through the SKYPE, medicines will be delivered as per doctor's instruction to the patient.

A simple mechanical setup with 3 gear motors and 3 storage pipes has been designed for medicine storage & delivery .

5. Conclusion

E-vending machine is focussed on satisfying the drastic need for health care, doctors and medicines. This device can be placed in rural areas and even in remote areas for providing instant medicines with the help of doctor's prescription in an effective way. The key objective of developing this system is to reduce health care costs by reducing travel expenditures, prolonged wait time and physician office visits, hospitalizations, and diagnostic testing procedures. The proposed work completes the test within short period of time and it also includes audio and video calling.

AMDM can further be enhanced or improved by adding facilities to monitor parameters such as blood pressure, blood sugar, weight. A Printer can also be interfaced with AMDM for printing the patient's medical report. The fixed monitoring system can also be made portable. The system can be developed for home use by patients those who are not in a critical condition but need to be constant or periodically monitored by clinician or family. In any critical condition the SMS is send to the doctor or any family member. A timer can be fixed in the medicine dispensing unit to remind the old aged people to take medicine at proper time without fail. The AMDM can be loaded with first aid materials such as Band-Aids, cotton, sanitizers etc., which are useful during emergency situations. Thus by using AMDM, many lives can be saved easily by providing them quick service.

6. References

[1] V. Ramesh ,"ATM Based Automated Medical Machine (AMM)" IJSR-International Journal for Scientific Research & amp; Development| Vol. 3, Issue01, 2015 | ISSN (online): 2321-0613

[2] G Umashankar, G Hari Krishnan, RJ Hemalatha, Sheeba Abraham,and Sindu Divakaran ,"Assistive System for Remote Accident Patients"Research Journal of Pharmaceutical, Biological and Chemical Sciences

[3] Shrikant Bhange, Kaveri Niphade, Tejshri Pachorkar, Akshay Pansare,"Automatic Medicine Vending Machine" International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 3, March 2015

[4] RakshaIyer, R.M. Potdar, Neelam Dewangan, Jayant Rajpurohit"Advancement of Low-cost Medicare System for the Measurement of Physiological Parameters of Human Body" International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249-8958, Volume-1, Issue-6, August 2012.