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IoT-Based Rural Medical ATM System

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ABSTRACT

This paper deals with the design, development, and deployment of an Automated Tele-Medicine dispenser system in rural areas. The main objective of our research is to design an Automated Tele-Medicine dispenser system to provide medical support to people who live in rural areas. The researchers claim that in rural areas opting for medical support is quite tedious, and even it takes more time and distance to reach out to a medical support area (Hospital). Sensor and connectivity technology are allowing devices to collect, record, and analyse data. The User or the Patient interacts with the machine and the purpose of the machine is to sense and record all the physical parameters of the user. This machine is built with two types of setups i.e., Manual and Automatic. In the Automatic mode, the machine will be fed with some of the normal symptoms that are caused to the Human's. Based on the response of the user, the machine will suggest some medicine related to the symptoms and disease. In Manual mode the device which is integrated with Audio and Video setup will connect to a doctor virtually with the help of the GSM Module, the patient can interact with the concerned doctor and report their health conditions. By the way, the patient will get medical support virtually and as an additional feature, the device is designed with a medicine dispenser. This medicine dispenser will dispense medicine in both modes based on the request and response.

Keywords : Automated Tele-Medicine dispenser system, GSM Module, medical support area, Medical ATM system, Rural IoT, PIC Microcontroller.

I. INTRODUCTION

Medical care includes diagnosing, prognosing, preventing, treating, palliating, and promoting the health of the patient. Medicine is the prevention and treatment of illness through the application of various healthcare practices. Using biomedical research, genetics, modern medicine diagnoses, biomedical science, medical technology, treats, and prevents injuries and diseases, typically by way of drugs or surgery, but also by using psychotherapy, external splints, medical devices, biologics, and radiation,

among others. Nowadays the availability of medical support is quite rich in cities and towns. Advancement of medical technologies helps to diagnose and cure vital diseases within the stipulated time. Some minor diseases can be cured easily by early diagnosis.

Healthcare is essential for preventing disease, diagnosing and treating illness, improving quality of life, avoiding preventable deaths, and extending life expectancy, according to Healthy People. The healthcare system in rural areas is often obstructed by barriers. A timely availability and attainable availability of healthcare services are necessary for rural residents. Healthcare access factors must be considered even when adequate healthcare services are available in the community.

Work, home, and recreational activities will all be redefined by remote patient monitoring. With these new technologies, we can monitor patients regularly, replacing recurring visits to the doctor. Blood pressure, blood oxygen saturation, and temperature are vital signs. We need nurse or doctor advice to check vital signs data to determine whether they are healthy or unhealthy. Data collection, recording, and analysis are enabled by advances in sensor and connectivity technology.

II. RELATED WORKS

Health issues were prevalent in rural areas 11.2% of the time. There were 15% of people who knew enough about health issues. 57.2% of the population acknowledged genetics as a risk factor and 46.9% recognized nutrition as a risk factor.

This study was conducted on the knowledge and awareness of adolescents about diabetic issues, specifically insulin resistance, in Kuwait. In this study, the aim was to identify the levels of awareness and knowledge of health problems in adolescents regarding the disease, which would prove to be a great help in preventing the development of health problems and their complications in the future.

This study of chronic health issues patients attending a Tertiary Care Teaching Hospital in India examined the knowledge of health issues and self-care practices of patients with chronic health issues. The study consisted of a total of 100 patients, of which 100 were included in the analysis.

According to the study, there is a need for improvements in knowledge and awareness both among the general population and among the health issues subjects in general. It is important to prevent health issues as well as the complications that could result from them as well as control them better.

An investigation was conducted into the prevalence of diabetes mellitus in rural Tamaka, Kolar, and the level of awareness about the disease. The researchers concluded that the results of this study reflect the insufficient knowledge and awareness of Indian rural residents about health-related issues. Accordingly, there is a need for the development of mass campaigns for health issues awareness in both urban and rural areas of the country to increase awareness of health issues.

This study was to determine and compare the level of awareness regarding Health issues Mellitus, its complications, and management in male & female health issues patients, which concluded that overall awareness of health issues for men and women is low; and compared to male patients, female patients were found to be less aware of health issues.

To plan health programs for patients, it is crucial to identify, investigate and assess the patient's knowledge of health issues, which can be beneficial in identifying which health programs should be put in place for them. A study conducted in this study reveals that several issues in healthcare need to be addressed in community health centers to improve patients' health issues knowledge.

III. PROPOSED METHOD

An Automated Tele-Medicine Support system aids the patient to diagnose their disease with vital signs. Designing a machine that is embedded with the Internet of Things and installing it in rural areas in the order it achieves user-friendly medical support. This proposed model has supported a wide range of connectivity and quick uninterrupted response. In order to sense the physical parameters of the Human Body we integrated the use of a Heart Beat Sensor, Respiratory Sensor, Load Sensor, Temperature Sensor, Ultrasonic Sensor, Glucose and Blood Pressure Sensor. The interface of various sensors is made with a PIC 16F877A microcontroller.

A wireless healthcare monitoring system utilizing an Internet of Things module is described in this proposal for a medical system. In order to provide immediate care, remote monitoring is regarded as an effective way to provide continuous and emergency information concerning a patient to the doctor or healthcare provider. Monitoring of patients remotely will have a profound impact on not only the hospital sector, but also on the workplace, the family, and recreational activities.

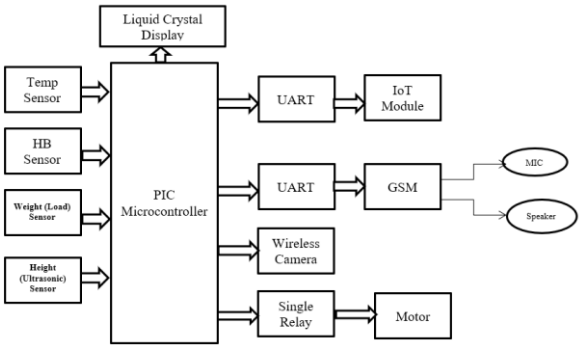

Figure 1: Block Diagram of Proposed System

Health management systems are intended to provide a low-cost integrated patient monitoring device that is primarily used to continuously monitor patients' health conditions, allowing for effective and accurate measurement of physiological parameters like temperature and pulse rate. Several wearable sensors are currently available for personal health care, fitness, and activity monitoring, and interest in wearable sensors has increased in recent years.

Healthcare that is related to the Internet of Things (IoT) network of connected devices is based on the Internet of Things (IoT) are connected in direct communication with one another Data collection and sharing that is essential to the patient. Using sensors, microcontrollers, and gateways, the data from the sensors can be analyzed further based on the input. The purpose of data mining is to extract information on Vital signs of health and illness of the individuals by using a classification model that does not require nurse assistance. Based on the data, medical professionals can diagnose and recommend treatment gathered via the chronic disease monitoring system through the use of an analysis of the data will be conducted using data mining algorithms, data mining algorithms, and medical sensors,

3.1 Hardware Components of Medical ATM System

In this section, we will have a look at the various components used in this proposed system. They are:

i. Transformer

In the proposed system we have used single-phase step-down transformers to convert higher voltage to lower voltage. The input for the transformer will be 230V from the single-phase source. It is used to reduce the supply voltage of the mains supply from 230 V AC to a lower value, using the Step-down Transformer.

ii. Rectifier Unit

This circuit converts the AC voltage into the DC voltage that it is supposed to represent through the use of a rectifier. In a Rectifier circuit, the diode is one of the most important and simplest devices that is used. It can be said that the diode performs a single function and that is to conduct if it is forward-biased and to not conduct when it is reverse-biased. There are three types of rectifiers that we are currently using in our system.

iii. Regulator Unit

Regulators are used to regulating the output voltage of a device so that it is always constant. I would like to

point out that despite fluctuations in the AC voltage input, the output voltage is always maintained. The DC voltage also changes as and when the AC voltage changes, as well as the other way around.

iv. Output Filter

In many cases, the filter circuit is placed after the regulator circuit to correct the problem. Several types of capacitors are commonly used as filters. There are two main principles involved in the operation of a capacitor: charging and discharging. In an AC system, the battery is charged during the positive half-cycle and discharged during the negative half-cycle of the AC voltage.

v. PIC Microcontroller (PIC16F87X)

In addition to the 256 bytes of EEPROM data memory, self-programming abilities, an ICD, two comparators, and eight channels of digital-to-analog (A/D) converters, the PIC16F877A is also equipped with two functions for capture, compare, and PWM. Finally, the configuration of a serial port can be synchronized to function as either 3-wire or 4-wire serial peripheral ports.

vi. Temperature Sensor

LM35 series temperature meters have a linear output signal. The temperature sensors are proportional to Celsius temperatures and are accurate IC temp devices. A significant advantage of the LM35 device is that it does not require subtracting a large amount of voltage from the output to calculate temperatures in the Centigrade. This is a benefit compared with linear sensors measured in Kelvin.

vii. Heart-Beat Sensor PCB Type

This board has a very simple operation and is very easy to use. To activate the IR sensor on the board, the Enable (EN) pin must be pulled high after the board has been powered from a 3-5.5V supply. The next step is to place your forefinger on the sensor's front side and gently place the tip of your finger on it.

viii. Load Sensor

A load sensor (also known as a "load cell") is an electronic device used for measuring tension and compression. Generally, loading sensors are used in household scales, in industrial scales, and they are also used in pulley cables and ropes for measuring tension, as well as determining how much weight an object has (such as in household scales).

ix. Ultra-Sonic Sensor

As an electronic device, an ultrasonic sensor measures the distance between an object and the emitter by emitting ultrasonic sound waves and measuring the return sound that is reflected by the object as an electrical signal. In the context of ultrasonic waves, it can be said that they travel faster than the speed of audible sounds (sounds that can be heard by humans).

x. Blood Pressure Sensor

A near-infrared spectral region (NIR) is part of a wide spectrum that falls between the visible and infrared bands and is capable of providing high biological permeability. This spectrum is often referred to as a "living-body window".

xi. GSM Module

To provide a wireless data link between the device and the network, a GSM modem or GSM module uses the GSM mobile telephone technology. Mobile telephones, as well as other equipment communicating with mobile telephone networks, use GSM modems as a means of communicating with these networks. Their devices are identified to the network by the SIM cards that they use.

IV. SIMULATION RESULTS AND DISCUSSION

With the help of the proteus software, the simulation results are analysed. It is a suite of software that can be used for designing schematics, simulations, and PCBs. Besides developing 3D drawings for the product, the designer also has the option of creating 2D drawings. In terms of software tools, Proteus is a proprietary tool suite that is used for electronic design automation and is marketed as a proprietary software suite. Software like this one is used primarily by electronic design engineers and technicians to help them create schematics and printed circuit board layouts that can

later be used by manufacturers to manufacture the circuit boards.

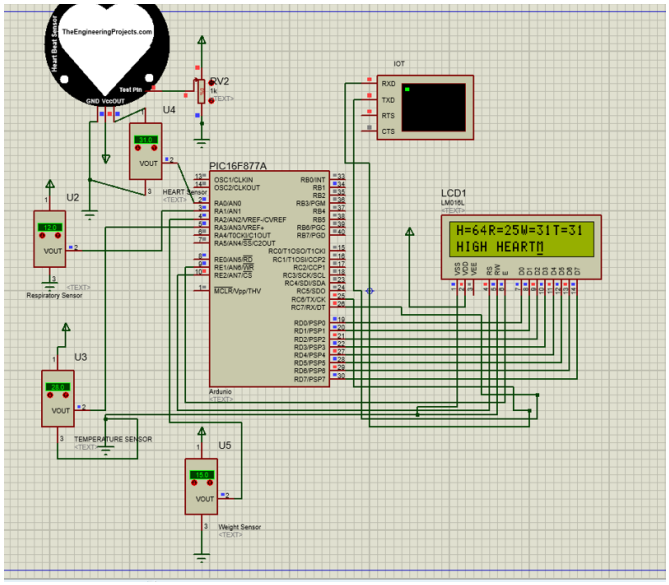

Figure 2. The schematic diagram for Simulation of Medical ATM

The Figure 2 is the simulation of a Medical ATM system interfaced with a PIC 16F877A Microcontroller using a Load sensor, Temperature, Blood pressure sensor, Heartbeat sensor, and ultra-sonic sensor.

The interfacing of various components that correspond to the Medical ATM system is built with the help of various sensors to sense the real-time vital signs of the human body. This hardware setup includes all the above-discussed sensors with their decoders as well.

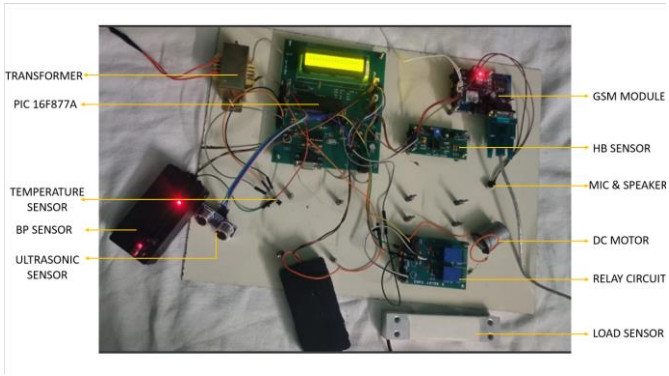

Figure 3. Hardware Interfacing of Medical ATM

4.1 User Interfaces of Medical ATM System

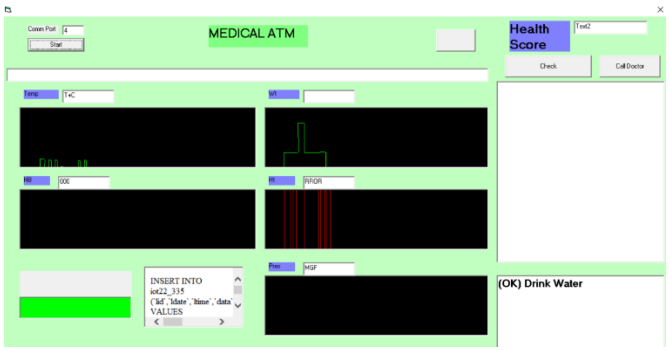

Figure 4. Patient's User Interface

The User Interface of the Patient's End which is developed with the help of visual studio displays the sensed parameter of vital signs like Body Temperature, Weight, Height, Blood Pressure per Minute, and Heartbeat Rate with a medicine prescription based on the input will be displayed.

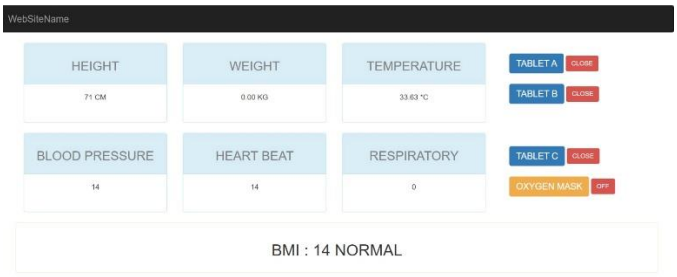

Figure 5. Doctor's User Interface

The User Interface of the Doctor's End will display all the sensed data which is designed and developed using Bootstrap (Frontend Framework Tool). These data will help the doctor while screening a patient.

For example, the system diagnoses the vital signs of the patient Body Weight=63kg, Body Height= 170 cm, Blood Pressure=125 mmHg, Heartbeat rate=70, Temperature = 33.6, and Respiratory rate = 12 bpm. So, with these data patients can consult with doctors. The doctor has the control to dispense the tablets to patients based on prescription.

V. CONCLUSION

The overall objective of the proposed system presents a novel IOT-based Medical ATM (Automated Tele-Medicine) System. It includes the interfacing, programming installation, and implementation of an Automated Tele-Medicine Dispenser in Rural areas. This will be an alternative for medical support in remote areas which is proposed to overcome the lack of medical facilities in rural areas. Approaching a sick patient from a remote area and diagnosing their illness is made even simpler with the help of IoT. Various vital signs of the human body are sensed and their results are discussed. The model of this proposed model is carried out in Proteus software and the results are discussed in detail. The proposed system has 2 modes of operation, which are chosen manually. Connecting a virtual call with the concerned doctor based on the user's request will develop a mutual interaction with the patient-physician relationship. Also, the hardware implementation of the medical ATM system is discussed which is integrated with two user interfaces namely, Doctor's UI and the Patient UI.

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