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A Medicinal Vending machine using IoT and machine Learning

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Abstract— *This project presents a machine designed to the people for their medical treatment which includes diagnosis and providing generic medicines. The major advantage is that a machine delivers the medicine in emergency and ensure availability of drugs 24x7. This project provides basic medication facilities to the people who are not benefited so far due to their remote location, during emergency hour, physically challenged and aged people. It allows user to select a medicine, pay the required amount after verifying amount it dispenses the medicine. It is mainly focused to treat minor health issues and to provide first aids. We studied the various aspects of this project. The literature survey consists of an implementation of different type of the sensors, the working principle of medicinal vending machine is explained in detail a methodology to build the vending machine using sensors, payment methods. For vending medicine, it uses a machine-learning algorithm for more accuracy and also uses the internet of things for sending data from the sensor to thecloud.*

Keywords—Raspberry pi, sensors, Internet of things, machine learning

I. INTRODUCTION

As we all see over the last few years technology has tremendously evolved and developed in medical field. But as compared to other nations we are still lagging in terms of automation in this field. In some metropolitan, these kinds of technology are used up to a very low scale. This development is still not reached in rural as well as a remote area.

This vending machine is an Automated dispensing machine decentralized medication distribution system that provides computer- controlled storage, dispensing, and tracking of medications that have been recommended as one potential mechanism to improve efficiency, and they are now widely used in many hospitals. There is no doubt that these machines can enhance the efficiency of medication distribution, but their capacity to reduce medication errors is controversial and depends on many factors, including how users to design and implement the systems..

If the consumer needs medicine at any odd hours, the pharmacy stores are not available and hence consumers will not able to get medicine in an emergency. Also In public places such as malls, bus/railway stations, on highways, areas where *medical* stores are limited. There are some margins of error while giving medicines to the consumer in the case of a pharmacist is not available. To overcome these problems we proposed a vending machine that uses two machine learning models. For the consumer, an option will be just select, pay and collect the medicine.
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II. LiteratureSurvey

TABLE 1
COMPARISON BETWEEN MAIN METHOD

Sr. No.	Paper Name	Advantages	Disadvantages
01.	Design and Implementation of Automatic Medicine Dispensing machine	It uses pulse rate sensors for checking the heart beat, temperature sensor for checking the fever.	Takes a lot of time to collect the data for particular medicine of various diseaseand form adatabase. At a time single medicine can be dispensed for a particular range in a given database
02.	All Time Medicine and Health Device	We have used the Raspberry Pi for both its low cost andits simplicity. Along with the heartbeat sensors and other features can be addedto make the machine diagnosis.	Requires clean environment for the sensors to operate and to give a proper reading neither if it gives wrong reading to machine it will dispense wrong medicine.
03.	Sensing in Coin Discriminators	Physical mechanisms and sensor related technologies used to achieve a good detection and discrimination of coins.	We can only use particular coins for payment which has a particular weight such has 5 rupees coin or 10 rupees coin
04	Sensors and related devices for IoT, medicine and smart-living	We can learn how to implement various sensors and how to use machine learning and IoT in the machine	Implementation of sensors are very difficult on the machine and programming is also very complicated also it takes time to build a program
05	Physical Sensors for Biomedical Applications	There are different types of physical sensors based on radiation, thermal and mechanical. Out of whichwe are going to use mechanical sensors to detect the pressure and thermal sensors to detect temperature of humanbody.	There are sensors which are very sensitive when comes in contact with the user. Mechanical sensors in the sense by pressing the sensors and taking reading digitally but user has to know how much to press on sensor neither it will damage the sensor.

III. MATERIAL ANDMETHOD

The vending machine proposes a simple design to vend the medicines with high accuracy and brings the objective to provide automation in the medical field. Automation deals with the reduction of human effort using electronics motors, sensors and components having mechanical mechanisms. It includes three simple stages select(input), pays and collect (Output). Here the inputs are given by LCD which is controlled by different switches and different sensors to take the readings. This machine has two options two dispense the medicines. A first option is a direct option that will direct dispense the medicines as per selection. In second option machine asks some queries to the consumer extract the keywords from response to that queries as input, also takes the reading from heart rate sensors and temperature sensors and finally proceeds the current data using a machine learning model to dispense the medicine with highaccuracy.

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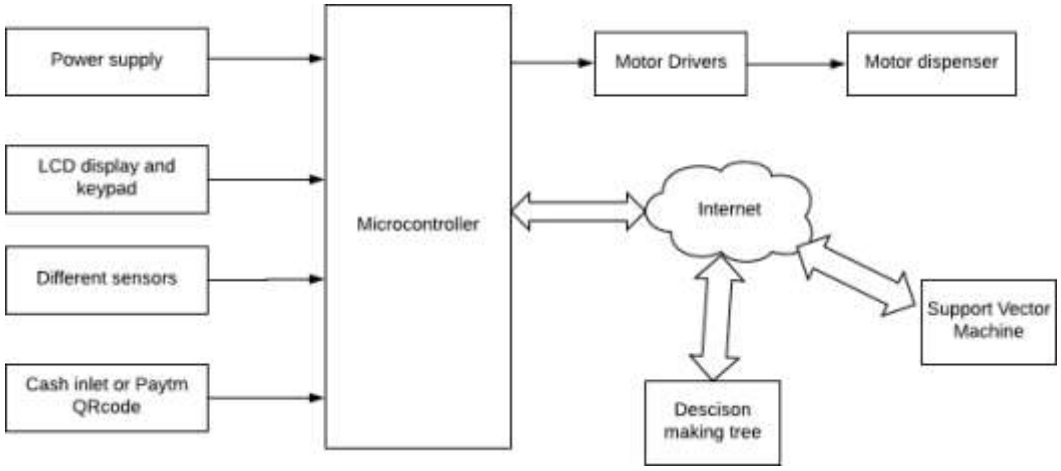

Figure 1 Block Diagram

IV. Proposedmethodology

Proposed methodology involves the procedure to design the medicinal vending machine which consists of different sensors, motors, LCD display, and main microcontroller. This paper proposes the use of raspberry pi as its main CPU which monitors the motors used to dispense the medicine and has interfaced sensors with it which will allow taking readings from the consumer. This reading will be updated on the cloud and displayed on the LCD display.

The queries will ask using this display and using switches consumers can answer to those queries. After the selection, the machine will ask the user to stick the sensors on the tip of the finger or limbs of the hand using the Velcro tape. Regarding instructions about the time will be provided to the user through a display. Since it is not feasible to wore sensors for more than one minute but to increase the accuracy of the data from sensors, this paper suggests to wait for 30 seconds. After the collection of data, this data will feed to the machine learning model as input and based on this data which contains extracted keywords, temperature and heart rate sensors then it will lead to dispense the according to medicine.

In this, 16X2 LCD display is interfaced to raspberry pi with its GPIO pins. It has 16 pins out of which 4 pins are interfaced with GPIO ports to display the required character on the screen, also pin register select (RS) and enable is interfaced toGPIO pin and there are Vcc and ground at pin number 2 and 1 respectively. All sensors and display work on the 5V power supply. Pulse rate sensor can be operated at both +5V and +3V power supply. It consists of three pins for ground, Vcc and pulsating output signal. This sensor has two sides, on one side there is the light sensor is present where the tip of the finger should be placed and another consist of some circuitry for noise cancellation purpose. Temperature sensor MAX30205 is used to sensor temperature which offers ±0.1°C (max) accuracy which meets thermometry specifications. This will provide high accuracy with moreefficiency.

To vend the medicine the dc motors with spring mechanism is used. After the appropriate signal, the motor will rotate the spring through 360° clockwise to vend the medicine. But the dc motors are operated at 12V power supply and we get only 5V of power supply from raspberry pi. Hence, this paper suggests using a relay circuit to step up the voltage for the operation of the dcmotor.

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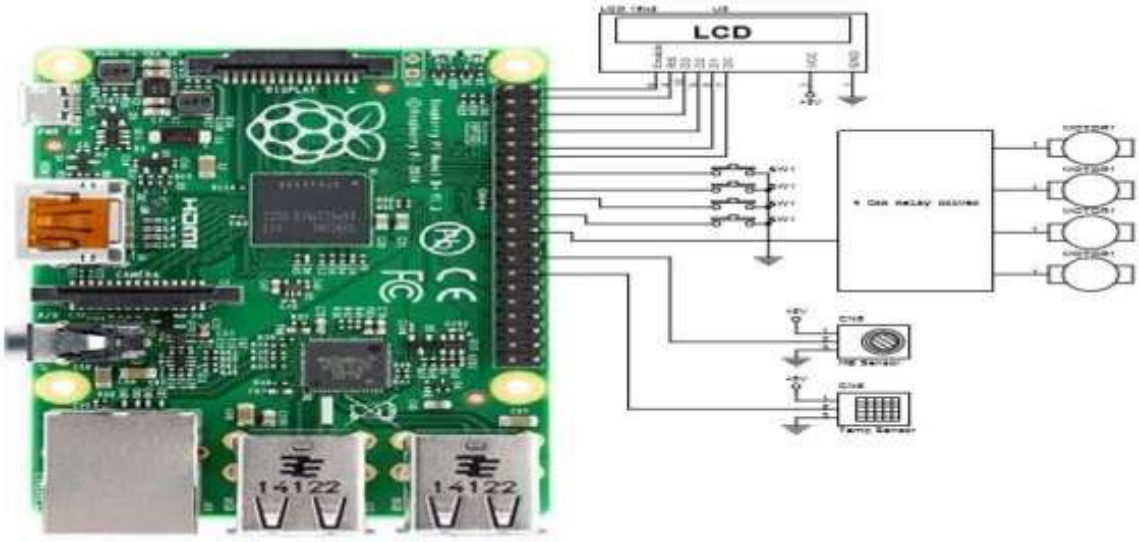

FIGURE 2: Internal Architecture

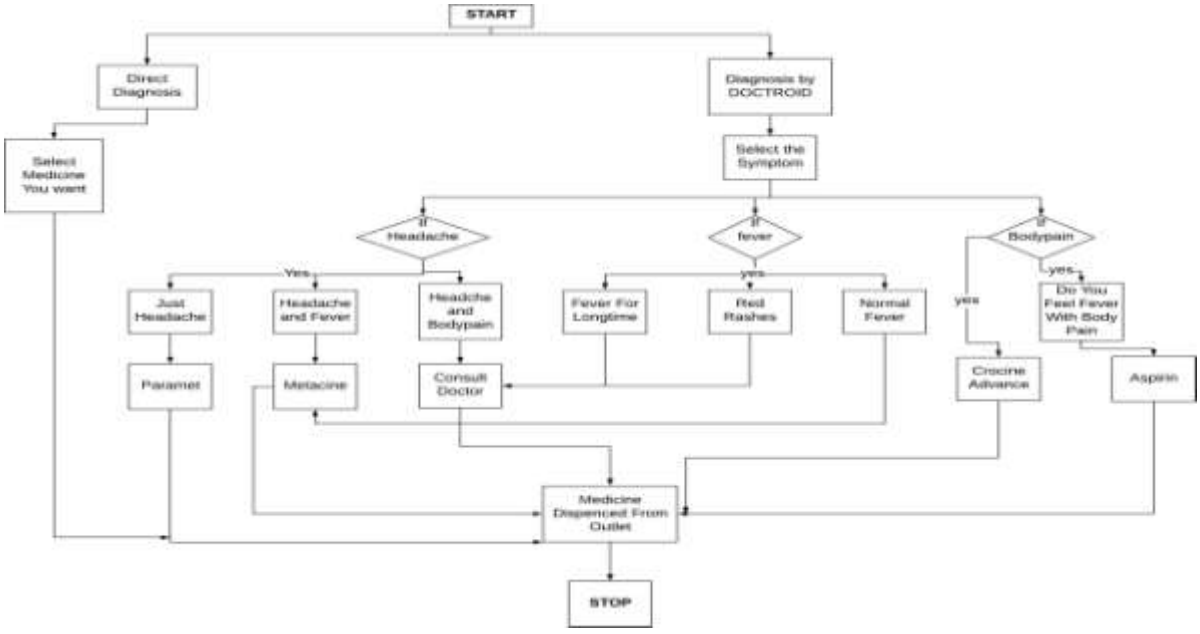

FIGURE 3: Flow Chart

First method is known as direct diagnosis. In this method user will select the required medicine and after making the payment the medicine will dispensed .In the second method machine ask some queries to the user regarding symptoms and according to the symptoms it will suggest the medicine. For example in the above flow chart as we see after selecting the second method for diagnosis the machine will ask the queries like headache, fever and body pain if user select headache then there will be another options like normal headache or headache with fever from these queries user will selectthesymptom and according to the symptom respective medicine will dispensed and if the medicine is not available for any symptom then machine will display the message that consult to the doctor.

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Decision making tree:

A decision tree is a tree-like graph with nodes representing the place where we pick an attribute and ask a question; edges represent the answers the to the question; and the leaves represent the actual output or class label. They are used in non-linear decision making with simple linear decision surface. Decision trees classify the examples by sorting them down the tree from the root to some leaf node, with the leaf node providing the classification to the example. Each node in the tree acts as a test case for some attribute, and each edge descending from that node corresponds to one of the possible answers to the test case. This process is recursive in nature and is repeated for every sub tree rooted at the new nodes.

SVM:

Support vector machine(SVM) is a discriminative classifier which is designed to classify the data by hyperplane. The main goal is to design a hyperplane that classify all vectors in the two categories. To chose the best hyperplane one should choose the plane that leaves the maximum margin from both class. When the data is distributed non-linearly, to optimize the task of minimize the total margin, it uses the Karush-Kuhn-Tucker using Lagrange multiplier equation for this task which is shownbelow:

$$\vec{\omega} = \sum_{i=0}^{N} \lambda_i y_i \vec{x}_i$$

$$\sum_{i=0}^{N} \lambda_i y_i = 0$$

Asthe magnitudeofwidthmargin(w)vectordecreases,itwillresultsintheincreasetheseparationofthehyperplane.

V. CONCLUSION

The proposal Medicine Vending Machine designed and implemented to improve health care in remote and rural areas by serving the patients for their basic ailments like fever, headache, first aid and so on. The Medicine Vending Machine is technically feasible to the peoples. It gives the availability of medicines all the time also in rural areas. It gives ease of access also. It dispenses the required medicine for the patient upon their request through a keypad interface and also by using the machine learning algorithm it predicts the appropriate medicine according to sensor data. The future update for this system includes incorporating IoT, which improvises the automation and controlling abilities of the system through a website or mobile application. The payment methods can be improved in the future also we can keep a record of every patient by giving them a unique id number for registration. Storage facilities can be improved in the future. Labor costs will be minimized and it will also give entrepreneurs the opportunity to attract more customers with this innovation. Finally, the Medicine Vending Machine to be set as the future trend to improve the health of a remote rural population.

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