KENKO HEALTHCARE KIOSK USING ARDUINO, VSM SENSORS AND ARTIFICIAL INTELLIGENCE

Mr.RAJIVE GANDHI[1], PANKHURI[2], AMRITA PADMANABAN[3], KIRAN KUMAR JAIN[4]

[1] *Department of Computer Science, SRM Institute of Science and Technology, Tamil Nadu, India*
[2]*Student,Department of Computer Science, SRM Institute of Science and Technology, Tamil Nadu, India*
[3] *Student,Department of Computer Science, SRM Institute of Science and Technology, Tamil Nadu, India*
[4]*Student,Department of Computer Science, SRM Institute of Science and Technology, Tamil Nadu, India*

ABSTRACT

Kiosks are one of the trending topics in the field of integrated devices that provide easy-to-access and one-stop services to the clients. The use of booths has beforehand been appeared to be powerful to collect data, conveying instructive modules, and giving access to wellbeing data. We talk about well-ordered strategies to incorporate health sensors utilizing Arduino to deduct and conclude differential determination of diseases and furthermore show treatment methodology and suggestions for the same; likewise, play out a basic leadership calculation with the dataset.

Keywords: - *Arduino, pulse sensor, temperature sensor, monitoring application, healthcare, dual diagnosis, VSM, AI learning, data sheet, KNN.*

1. INTRODUCTION

Individuals have been giving careful consideration to their wellbeing status. The focal point of current medicinal treatment is step by step changed to counteractive action of infections and change of physical wellness, e.g. by means of early cautioning of infection. Rather than going to clinic, a few people will have an advantageous gadget to screen their long haul bio-information financially and effortlessly. Then again, there are numerous necessities for general and valid therapeutic data pushing stage for people in general.

We are focused on bringing to life 3 main modules: (1) Graphical User Interface (2) VSM - Vital Signs Monitoring (3) AI dual diagnosis. This paper proposes a minimal effort, reduced and extendable medicinal services stand which is accessible for applications in view of a closed community. This forms for the most part settle the issue of bio-information gathering and preprocessing at open place. It's an augmentation of healing center capacity, and goes about as a supplementary approach of day by day physical examination for the general population. By estimating ECG, blood pressure, weight, temperature and blood oxygen saturation, it can enable individuals to perceive the anomalous wellbeing status and give comparing guidance auspicious with less cost. The kiosk influences medicinal services to benefit open to anybody at anytime.

2. TECHNICAL FRAMEWORK

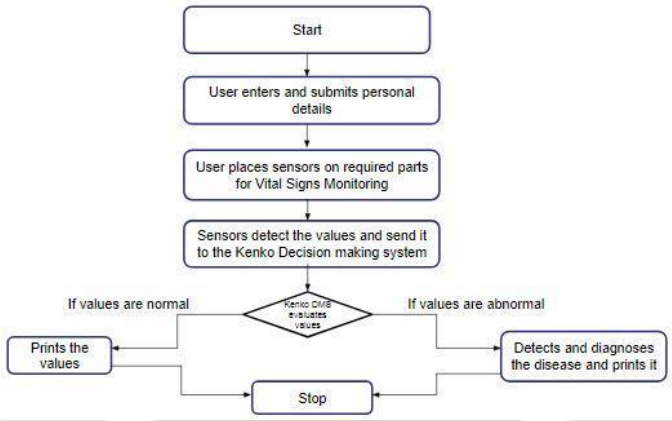


Fig -1: Workflow steps for each module

2.1 Graphical User Interface

A GUI to delineate the enlistment part when the client starts his work. Fundamental subtle elements of the client are taken and shown on the screen and making GUI utilizing Tkinter module of Python (3.5.2). Utilizing the standard GUI Tkinter gives a snappy and straightforward way to deal with make GUI applications using Python.[2] Creating a GUI application using Tkinter is a straightforward assignment. This realizes an online association, likewise, an electronic connection that allow easy to use shape and change progression with no programming learning.

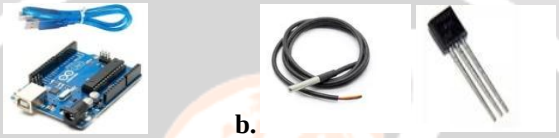
Fig -2 : GUI front end view to the user

As we separate the necessities, the going with essentials are crucial in our proposed course of action. : 1) Usage of structures for self-advantage kiosk. On a self-advantage kiosk, the structures fill in as canny hopes to get duty from an end-customer. Routinely, the structures are not static, and the progress fluctuates as per the information gave by a specific end-customer. Thusly, the application ought to fortify flexible progress between shapes that finishes the layout. 2) Technology pragmatist approach the structures on a self association slow down are regularly changed by in reality organized work compel, the people who are in truth sound. An impeccable approach is to give diagram creation without requiring particular specific learning, for example, programming. To address this need, the application ought to be masterminded in a way where structures and changes can be made without the need of the particular aptitudes. 3) Target clients are non-particular, non-specific customers. Not just the structures and propel age ought to be made innovation rationalist, yet the game-plan ought to in like way be made clear for target outline

originators. Thusly, the shape creation and game plan ought to be made usable to nearly everybody, not constrained to just customers with specific particular data. To fulfil the above necessities, the parts are - firstly, there are gets that more routinely trigger the accompanying activities or display choices. Besides, there are propels that pass on the dedication from a customer. Thirdly, there are progresses between pages that are frequently dependant on the gets picked by the customer (through the first part) or characteristics entered by customers (in the midst of that time segment). Recalling the genuine goal to plan a framework that engages structures to be made and remained mindful of no specific particular aptitudes, all the above parts ought to be isolated and summed up. We can see these structures as limits. They take after limits found in programming vernaculars. The flow control between structures can be occupied as a system flows. Precisely when shapes are made hypothetical, the backend structure needs the capacity to unwind the pined for limits (structures) and process flows (flow control) decisively.

2.2 Vital Signs Monitoring Devices

Following are the two monitoring gadgets in our system, i.e. Arduino board, pulse sensor monitor, temperature sensor. They are updated in view of the current ones which can be purchased from business sectors and are chosen by adjusting of cost, performance and execution.



a. **b.**

Fig -3: Main hardware integrating devices

Figure 3(a) is The Arduino. Not in the slightest degree like most past programmable circuit sheets, the Arduino does not require an alternate piece of gear you can fundamentally use a USB connect. Also, the Arduino IDE uses a reworked variant of C++, making it less requesting and simple to code. Finally, Arduino gives a standard frame factor that breaks out the elements of the microcontroller into a more available bundle. The Arduino UNO board has five simple information pins A0 through A5. These pins can read from the simple sensor like the stickiness sensor or temperature sensor and change over it into a computerized esteem that can be perused by the microchip. Each Arduino board has its own specific microcontroller. You can acknowledge it as the psyche of your board. The fundamental IC (coordinated circuit) on the Arduino is to some degree not exactly the same as the cerebrum. You ought to acknowledge what IC your board has before stacking another program from the Arduino IDE. The Power LED marker lights up when you associate your Arduino to a power source to show that your board is fueled successfully. In case this light does not turn on, by then there is some sort of issue with the association. [8]

Figure 3(b) is the temperature sensor (DS1820), the sensor is a 1-wire digital temperature sensor. This means that you can read the temperature with a very simple circuit setup. It communicates on common bus, which means that you can connect several devices and read their values using just one digital pin of the Arduino. Some main features of this sensor is, it communicates over a 1-bus communication, its operating range is from -55 to 125 degree Celsius. Another cool component is that you can interface up to 127 of these sensors in parallel, and read every individual temperature. Subsequently, it is easy to utilize one microchip to check many DS18B20s dispersed over a large area.

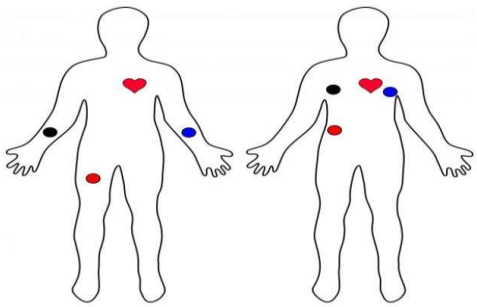


Fig -4: Typical sensor placements

These devices are critical to making the kiosk economic and easy to maintain. This will make it easy for diagnosis of the user according to his lifestyle.

3. LITERATURE SURVEY FOR EXISTING SYSTEMS

Table -1: Literature survey data

S.no	Name of the System	Properties	Drawbacks
1	Svark[1]	Health atm, Personal health manager, Prescription manager	Less cost efficient
2	Yolo Nigeria[2]	Automated Health Screening, Measures the value of vitals	Uses large medical instruments.
3	Higi[3]	Automated ATM to connect with pharmacy and track health	Stores vitals and biometrics and helps reach a doctor
4	Verona[4]	Hospital check-in kiosk	Does not diagnose any disease
5	Mobile Kiosk[5]	Send alarm when value abnormal	End work again to be performed by doctor
6	Boston 2.0[6]	Provides pre-functions before checking in a hospital	Does not diagnose any disease

3.1 Challenges of Existing Systems

● Costly to integrate with the entire device. Since a lot of sensors and devices are used, the overall cost of the kiosk would not be economic.

- Heavy materials are used in these systems. It would be difficult to install as well as commute to other places.
- Difficult to integrate with complex devices, using expensive integration circuits.
- Receive delivery / Vending machine.
- provides an interface to communicate with a doctor/ does not diagnose any disease / does not act as a doctor.
- Does not reduce effort, time and resources

4. DESIGN ARCHITECTURE

The design of the kiosk is very important. It must be seen by users and the motivation should be clear. Basic material might be given and the framework should seem basic and instinctive to utilize. It should likewise take into account those with little skills or encounter and with physical constraints and cognitive impairment. The system must able to provide information of the connection procedure and return naturally to an underlying state if utilization has ended. There is an outright need to secure the protection of the users' records.

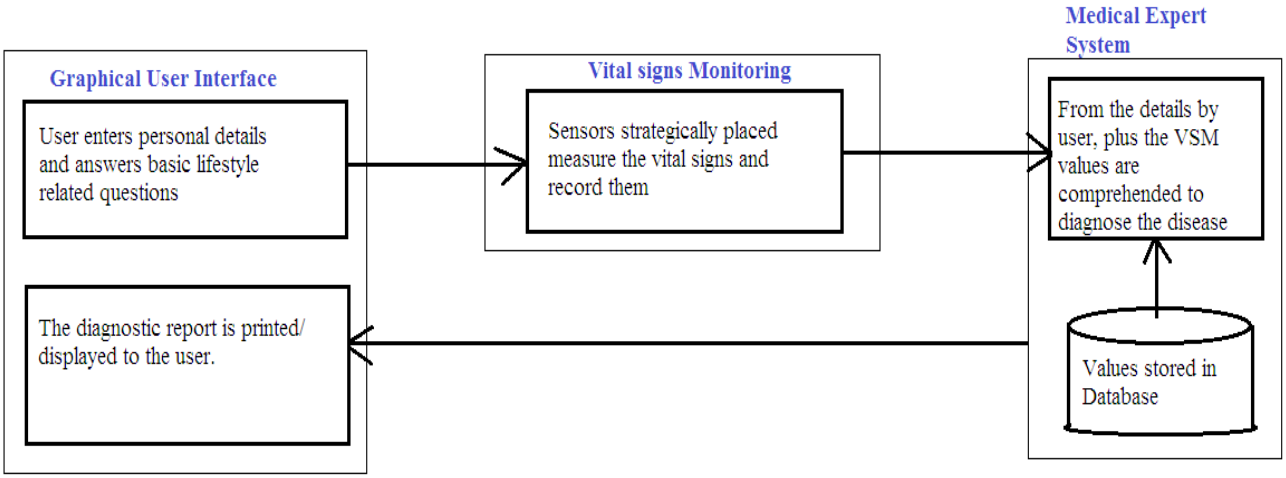


Fig -5 : Proposed system design

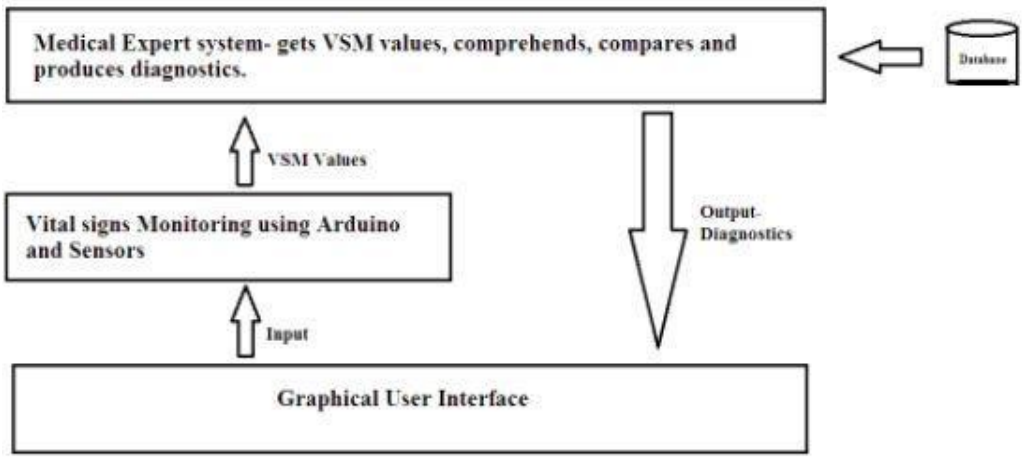


Fig -6: Proposed system architecture

The nature of the system brings two issues. First, the creation of a system, regardless of a straightforward or complex one, will require the engagement of expert engineers. Non-technical users won't have the capacity to perform the tasks. Furthermore, the first issue will likewise prompt the issue of cost. Especially for littler organizations with a constrained spending plan, creation and resulting modifications will bring about extra expenses. Optimistically, if the capacity to make and alter a self-benefit kiosk framework can be offered to a kiosk proprietor who is with no specialized technical knowledge, he would then be able to make and maintain the system independently. This can be an advantage since he/she can settle on claim choices in making, acquiring and utilizing his/her desired frameworks.

4.1 Considerations

Basic arrangement examinations for a kiosk framework requires: 1) conveyability of gear, 2) Modular way to deal with manage data area, 3) Visual ease, and 4) Physical and mental ease of use. The blueprint should likewise guarantee: 1) Information section autonomous of console utilize 2) A sight and sound approach to manage social occasion and dispersal of patient specific prosperity information, 3) Plain dialect, 4) Semantic mapping of patient level dialect to therapeutic thoughts, and 5) Embedded altering and mistake checking strategies to ensure maximal precision of patients' information. At long last, ensure that the security of the kiosk isn't haggled either locally or remotely.

4.2 Identification and Usage

With a specific end goal to give a redid framework to a self-benefit stand, the progress of the structures is typically customized by experts. Segments, for example, structures, discoursed and advances should have been outlined and created. This nature brings two issues. Initially, the making of a framework, regardless of a straightforward or a different one, will require the involvement with expert engineers. Non-specialized clients won't have the capacity to play out this undertakings.

Furthermore, the first issue will likewise prompt the issue of cost. Especially for littler organizations with a constrained spending plan, creation and resulting modifications will cause extra expenses. Optimistically, if the capacity to make and alter a self-benefit booth framework can be offered to a stand proprietor who is with no specialized know-how, he would then be able to make and keep up the coveted framework autonomously. This can be favorable position since he/she can settle on claim choices in making, getting and utilizing his/her coveted frameworks.

5. IMPLEMENTATIONS

Following are the vital sign ranges that will inherently help in determining the type and characteristic of the existing disease and dual diagnosis. (1) Normal pulse rate: 60 to 100 bpm (2) Abnormal pulse rate: Above 100 beats per minute (3) Normal temperature: 97° F to 99°F (4) Abnormal temperature: Above 100°F (5) Normal respiratory rate: 12 to 20 breaths per minute (6) Abnormal respiratory rate: Below 12 or above 20 breaths per minute.
Following are the specified screenshots of the deliverables:

Fig -7: Registration UI screen in Python

5.1 Pulse range and diagnosis for user lifestyle

Pulse readings can be calculated as Systolic pressure - the Diastolic pressure. The number on the top indicates the amount of pressure in the arteries during the contraction of the heart muscle, which is, the systolic pressure. The number below refers to the pressure when the heart muscle is between beats, which is the diastolic pressure. Normal rates for the blood pressure is 120/80 and pulse rates is 40 (120-80). Our diagnosis goal is to check for indicators for a heart disease or a stroke risk. General questions to kick start the diagnosis: (1) Are you an athlete? (2) Are you a working person? (3) Are you overweight? (4) Do you perform regular physical activities? (5) Intensity of exercise? (6) Diagnosis depending on age group [high, medium, low] (7) any history of heart disease in family? (8) Check for other physical ailments [sinus, pneumonia, asthma etc.,] and so on. [5]Certain conditions to look up to:

(i) If the Systolic pressure is <120 and Diastolic pressure is <80 => Normal!

Diagnosis: Physically fit readings. Maintain this healthy diet and perform regular exercise.

(ii) If the Systolic pressure is >=120 and Diastolic pressure is <80 => Elevated!

Diagnosis: You are likely to develop high blood pressure unless you take steps to control it. Lifestyle changes necessary. Make healthy food choices. Eat food items low in salt content.

(iii) If the Systolic pressure is >=130 and Diastolic pressure is <80 and <=89 => Hypertension Stage -1!

Diagnosis: Perform lifestyle changes. High chances of ASVCD. Measure your intake and perform a medical examination to keep track of your health.

(iv) If the Systolic pressure is >=140120 and Diastolic pressure is >=90 =>Hypertension Stage-2!

Diagnosis: Doctors may prescribe a combination of blood pressure medications along with lifestyle changes. Checks for frequent fainting, occasional choking. Perform electrocardiography, blood and urine tests. High risk for heart disease.

(v) If the Systolic pressure is >180 and Diastolic pressure is >=120 => Hypertensive Crisis!

Diagnosis: You are experiencing signs of possible organ damage such as chest pains, shortness of breath, back pains, weakness, vision changes, difficulty in speaking, etc. Keep emergency contact on speed dial in case of need. Consult a doctor immediately!

Fig -8 : Pulse sensor evaluation screen using Arduino

Sedentary lifestyle, obesity, smoking and drinking weakens the heart. Stress anger and nervousness also trigger these conditions. Choose alternate therapies like yoga, meditation, acupuncture and reiki may also help. Choose lifestyle changes as long standing hypertension can cause vital organ failures, internal bleeding and seizures due to swelling in the brain. Normal rate for (i) Children (6-15 years of age) can have the range 70-100 bpm. (ii) Adults (18+ years of age) can have the range 60-100 bpm.

5.2 Heart rate and diagnosis for user

Abnormal rates (i) If the heart rate is greater or equal to 150 bpm, it needs medical attention. This can be a case of SVT, Supraventricular tachycardia. (ii) If the heart rate is less than 60 bpm, there are high risks for heart attacks. This can cause problems with the sinoatrial node, also known as pacemaker.]
Diagnosis for SVT (high heart rate):

- Check for reactions to certain medications.
- Too much alcohol consumption needs to be reduced.
- Reaction of certain drugs.
- Balancing electrolytes in the body.
- Result of an overactive thyroid gland.
- Cardioversion- delivering electric shock to the heart.
- Vagal maneuvers- This is a nerve that gets affected by coughing, heaving, etc.
- Diagnosis for Bradycardia(low heart rate):
- Certain medications might be of help.
- Keeping thyroid rates under control.
- Beta blockers can be used to relax your heart muscle.
- Quit smoking, it could aggravate your condition.
- Maintaining cholesterol and sugar levels.

5.3 Temperature ranges and diagnosis for user lifestyle

Speaking of temperature ranges, the range and the readings keep changing throughout the day. A few factors depends on: (1) How active you are (2) the time of the day (3) Age and gender (4) Eating habits (5) if a women is on her menstrual cycle, it fluctuates as well.
General temperature readings:
(i) If the temperature is less than 100F,it's normal.
(ii) If the reading is greater than 103F, consult a doctor immediately for dual diagnosis.
Extreme conditions:
(i) Hypothermia: When the body loses heat, the results can be fatal. Reading less than 95F
(ii) Severe hypothermia: Reading less than 82F
Diagnosis:

- Spend time outdoors if possible.
- Wear warm blankets or clothes.
- Drink warm, sweet beverages.
- Perform CPR - if consciousness is lost.
- Keep constant check on temperature if necessary.

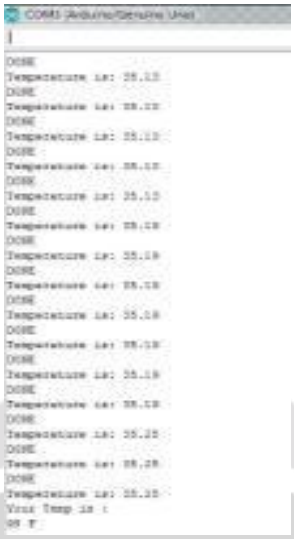


Fig -9: Temperature sensor evaluation using Arduino

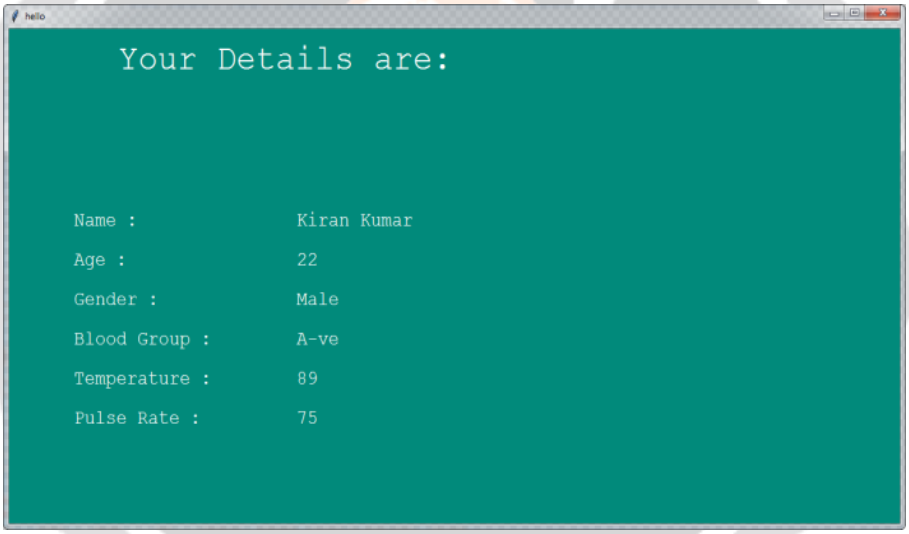


Fig -10: Integration of all modules (UI, VSM, Analytics)

5.4 KNN algorithm implementation and accuracy

Using the decision making algorithms in AI, classifiers can be used in order to classify the diseases with the help of the given symptoms. The classifier used in KNN- K nearest neighbor. Using this algorithm, the system is trained in such a way that it checks for the nearest k points in the test dataset. The nearest distance is determined using Euclidean distance. The formula for the same is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. An appropriate K value needs to be set in order to achieve an accurate prediction. Usually k value needs to be an odd number so as to facilitate comparison.

Following are the accuracy related details for the above concept implementation in Kenko kiosk with the dataset that has been used:

When k=1, accuracy= 90%

When k=3, accuracy=70%

5.5 Output generation

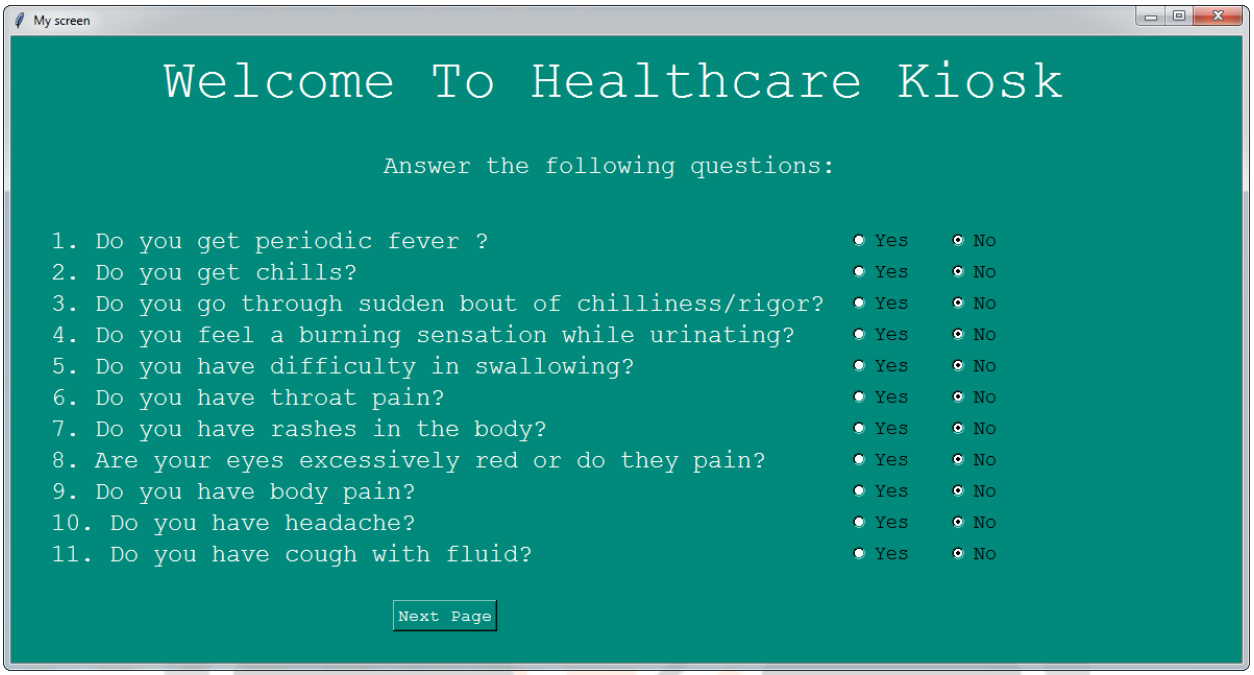
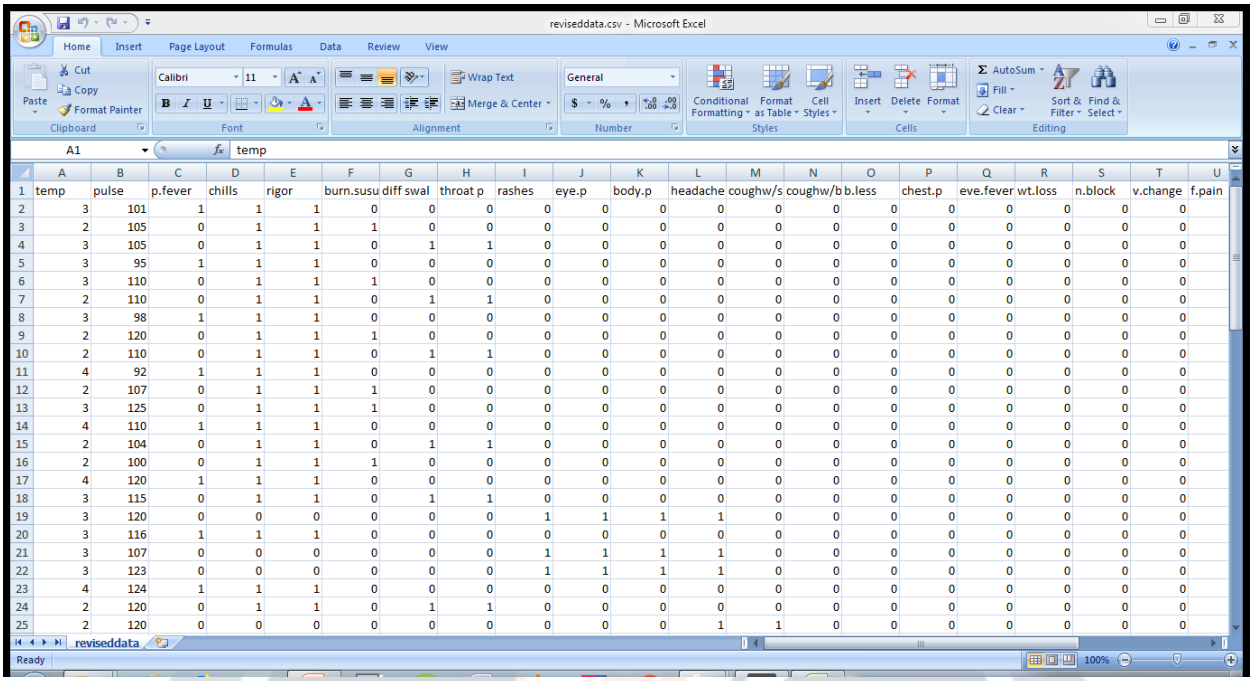


Fig -11 : Questionnaire - Screen 1

Fig -12: Questionnaire - Screen 2



reviseddata.csv - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	temp	pulse	p.fever	chills	rigor	burn.susu	diff swal	throat p	rashes	eye.p	body.p	headache	coughw/s	coughw/b	b.less	chest.p	eve.fever	wt.loss	n.block	v.change	f.pain
2	3	101	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	2	105	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	3	105	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
5	3	95	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	3	110	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	2	110	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
8	3	98	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	2	120	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	2	110	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
11	4	92	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	2	107	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	3	125	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	4	110	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	2	104	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
16	2	100	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17	4	120	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18	3	115	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
19	3	120	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	
20	3	116	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
21	3	107	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	
22	3	123	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	
23	4	124	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	2	120	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
25	2	120	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	

Fig -13: Data sets

The dataset consists of Temperature as well as the pulse value range with symptoms of various diseases marked as 1 or 0 i.e. yes or no. Finally it contains labels (names) of various diseases.

Fig -14: Diagnosis of disease

6. CONCLUSIONS

Data kiosks are broadly utilized and positively acknowledged by the overall population. Sending of medicinal services kiosks in both group and restorative establishment settings is a viable, proficient, and ease strategy for giving social insurance data and can enhance human services results of the intended interest group paying little heed to age, sexual orientation, race, dialect, education, socioeconomics, and past PC learning. To begin with, clients can get to it with only a web UI program, not requiring a particular undertakings due to usage of server development. Second, it enables high detectable quality, accommodation, and flexibility for clients by using Web Figure. Likewise, it moreover enables clients to spare information and designs.

7. ACKNOWLEDGEMENT

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