An Ingenious Nano Cautionary Iot Mobile App System For Myocardial Infarction Using Salivary Biomarkers

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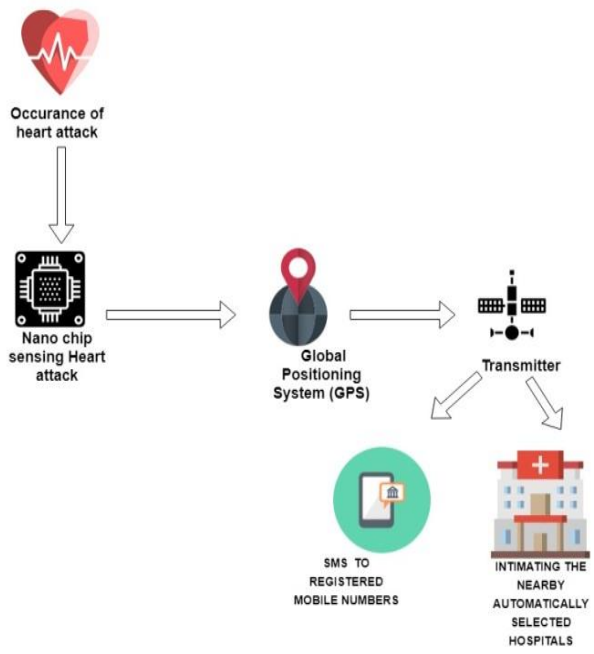
Abstract- *LIFE DOESN'T GIVE A SECOND CHANCE BUT DEATH DOES. HEART ATTACK also termed as "MYOCARDIAL INFARCTION" (MI), is a life threatening condition in which the blood drift is abruptly stopedcausing tissue damage. MI brings down people on icy grounds despite their ages. It includes symptoms like chest pain, shortness of breath, nausea, dizziness, a cold sweat, tiredness. Acute chest discomfort may radiate into other organs like left arm shoulder, back neck and left mandible. The proposed innovative Nano Non-Invasive chip when implanted on teeth will give us a smart decision to render immediate medical help for the MI patient to save his/her life. .This Nano chip consist of sensors of Salivary Biomarker, GPS, Microcontroller, Database and Transmitter. The Microcontroller does the comparison of Biomarkers such as CREATINE KINASE (CK), TROPONIN etc. that are present in the saliva during the time of MI on the basis of their threshold values it confirms the heart attack. Once it isconfirmed, the Database and the GPS location of the patient are transmitted to the registered mobile numbers and to the automatically selected nearby hospital via Transmitter. Saliva collection has been proven non-invasive, convenient, and inexpensive technique compared to Phlebotomy. Thus saliva is used as a tool for diagnostic fluid for MI. This innovative device will be activated through IOT Mobile application which will intimate the current status of the MI patient. This advanced tool may be life saving for patients suffering from acute MI thereby reducing the Global mortality rate.*

Keywords- Myocardial Infarction(MI), Heart attack ,tooth, Salivary Biomarkers, Phlebotomy, GPS, Nano cautionary system, IOT Mobile application , Troponin, Creatine Kinase.

I. INTRODUCTION

Among the mortality rate of Cardio Vascular Diseases(CVDs) 85% are due to heart attack and stroke. Myocardial Infarction commonly known as a heart attack, which occurs due to decrease in blood supply and reduces oxygen supply to the heart muscles. The most common symptoms are shortness of breath, nausea, dizziness, a cold sweat, tiredness and elevates troponin and creatine kinase levels in blood. The Acute chest discomfort may radiate into other organs such as left arm shoulder, back neck and left lower jaw. Diagnostic methods used to find out myocardial infarction are Electrocardiograms (ECGs),coronary angiography, Commonly used blood tests that is Phlebotomy which includes the test of troponin and creatine Kinase MB levels in the blood of a person.People affected by heart attack has been increasing every year



Usually Myocardial infarction is tested by a long procedure which includes taking a sample of blood from a person and testing the amount of kinase and troponin levels in the blood sample which leads to the wastage of time. The person is said to be healthy if troponin range is between 0.00-0.40.If it exceeds more the given range it means heart damage. In a healthy adult, the serum CK normal rangefor amen is less than 140 U/ml (units per millilitre) and for a women is less than 100 U/ml(units per millilitre). Higher

amounts of body fluid Creatine Kinase can indicate muscle injury because of chronic sickness or acute muscle injury.

Mortality rate increases due to unpredictable Myocardial Infarction in the world wide, The proposed innovative Nano Non-Invasive chip when implanted on teeth will give us a smart decision to render immediate medical help for the Myocardial Infarction patient to save his/her life. This innovative Nano Non-Invasive chip consist of sensors of Salivary Biomarker, Global Positioning System(GPS), Microcontroller, Database and Transmitter. Salivary Biomarkers analyse the creatine kinase, troponin, myoglobin, etc.

The Microcontroller compares the level of CREATINE KINASE (CK), TROPONIN etc. that are secreted in the saliva at the time of Myocardial Infarction on the basis of their threshold values and it confirms the heart attack. Once it is confirmed, the Database and the Global Positioning System(GPS) location of the patient are transmitted to the registered mobile numbers and to the automatically selected nearby hospital via Transmitter.

The database contains biography of a patient, drug that a he/she consumes, past medical history report and dental history report of a patient. Saliva collection has been proven non-invasive, convenient, and inexpensive technique compared to Phlebotomy. These distinctive advantages of saliva provide a promising potential as a diagnostic fluid for Myocardial Infarction. This innovative device will be activated through IOT Mobile application which will intimate the current status of the Myocardial Infarction patient. This advanced tool may be life saving for patients suffering from acute Myocardial Infarction thereby reducing the Global mortality rate.

II. EXISTING SYSTEM

A new handheld biopsy device is in a position to rapidly diagnosis heart attacks at the purpose of care. The **Minicare I-20 handheld device**, developed by Philips, is designed for use in emergency departments to dramatically reduce the time physicians take to diagnose heart attacks. Using just a single droplet of blood, the device detects proteins present within the blood stream following a attack and provides a result in 10 minutes rather than the standard 60-minute wait for lab results.

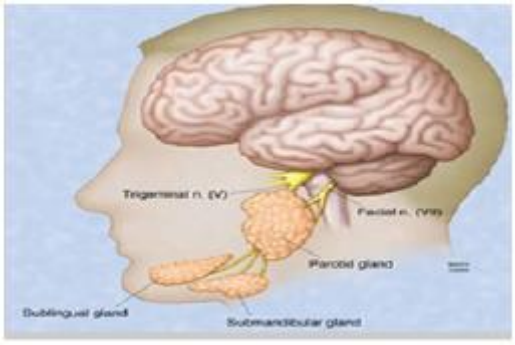
For patients in emergency departments with chest pains, the device can be used to administer an instantaneous test, with results delivered while the patient is being assessed and a medical history taken. This reduces the time for the physician to make a decision on treatment. Using the device simplifies the patient-doctor interaction and improves the way during which physicians are ready to deliver care.

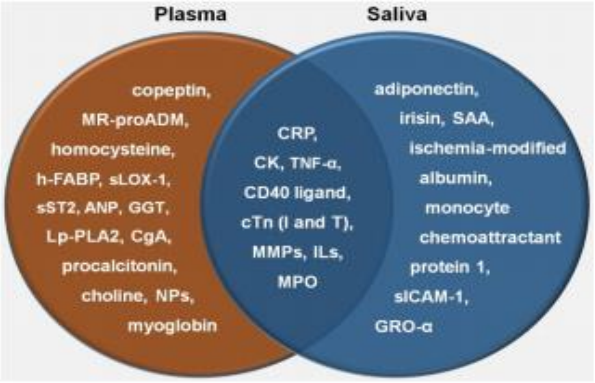
The system works by measuring the level of cardiac troponin1(cTn1), a protein that is excreted by the heart muscle into the blood following a heart attack.

The blood levels peaks only upto 12 to 26 hours, thus this method cannot be used when time levels exceeds. There are chances for blood clot during phlebotamy.

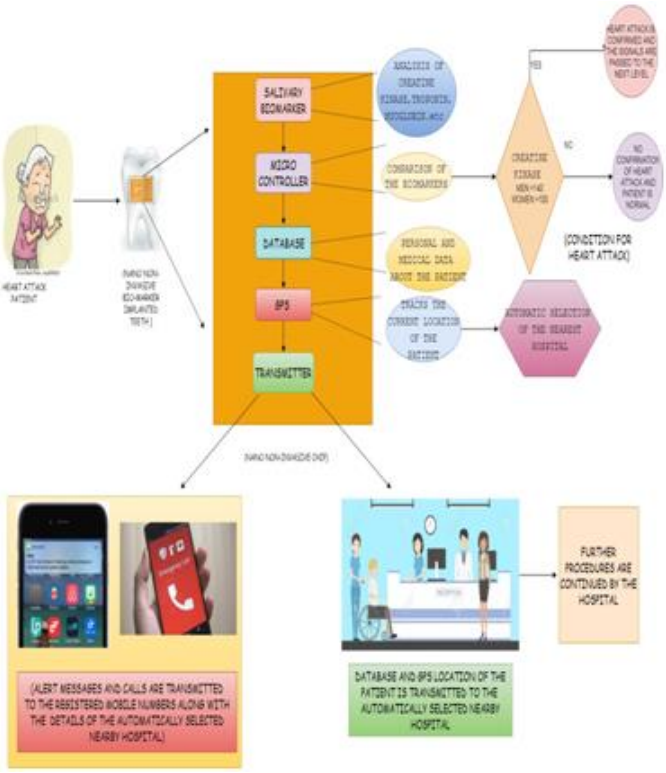
III. PROPOSED SYSTEM

In the proposed system, we propose the usage of **salivary biomarkers** for the detection of myocardial infarction. Salivary Biomarkers can be an indicative of a specific physiological or pathological state of a biological fluid including blood and saliva. Saliva collection was proven to be **48% less costly than blood collection.** This salivary biomarker is a **nano non invasive chip**. Salivary biomarkers are implanted in the teeth at the site of parotid gland. 27% of whole saliva protiens are found both in saliva and plasma also includes CRP (C- Reactive Protien), CK (Creatine Kinase),CD40 Ligand and so on. The major protein used in the detection of myocardial infarction using salivary biomarker is CK(Creatine Kinase).





ARCHITECTURAL DIAGRAM

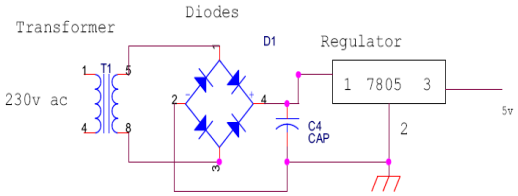


MODULES:

MODULES:

A. T4_POWER_SUPPLY
B. ARDUINO UNO
C. 16-2 LCD
D. IoT BOARD V2.0
E. ANDROID DEVELOPMENT

T4_POWER_SUPPLY:



Power supply unit consists of following units**:**

1) Step down transformer
2) Rectifier unit
3) Input filter
4) Regulator unit
5) Output filter

STEPDOWN TRANSFORMER:

The Step down Transformer is employed to step down the most supply voltage from 230V AC to lower value. This 230 AC voltage can't be used directly, thus it's stepped down. The Transformer consists of primary and secondary coils. To reduce or step down the voltage, the transformer is supposed to contain less number of turns in its secondary core. The output from the secondary coil is additionally AC waveform. Thus the conversion from AC to DC is vital thus it is done by using the Rectifier Circuit/Unit.

Step down transformers can step down incoming voltage, which enables you to possess the proper voltage input for your electrical needs, as an example if our equipment has been specified for input voltage of 12 volts, and thus the most power supply is 230 volts.

RECTIFIER UNIT:

AC voltage is converted into corresponding DC voltage using Rectifier. The most important and straightforward device utilized in Rectifier circuit is that the diode. The function of the diode is that it acts as a one-way switch. It conduct when forward biased and not to conduct in reverse bias. We use three types of rectifiers. They are:

- Half-wave rectifier
- Full-wave rectifier
- Bridge rectifier

INPUT FILTER

Capacitors are used as high pass and low pass filter. Ripple is the periodic variation of the DC voltage within a power supply which has been derived from an AC source. The ripples from the pure DC voltage is obtained. capacitors can reduce the harmonics of the input voltage. The primary action performed by capacitor is charging at the peak voltage and discharging after the peak value is passed. It charges in positive half cycle of the AC voltage and it'll discharge in negative half cycle. So it allows only AC voltage and doesn't allow the DC voltage. The output of the rectifier has to be passed through a filter circuit which is free from ripples. Filters used are of two types. They are

- Low pass filter
- High pass filter

REGULATOR UNIT

7805 Regulator

Regulator is a device used toregulates the output voltage to be always constant. The output voltage is maintained regardless the fluctuations within the input AC voltage. As then the AC voltage changes, the DC voltage also changes. So, to avoid this situation Regulators are used. Also when the internal resistance of the facility supply is bigger than 30 ohms, the output gets affected

OUTPUT FILTER

The Filter circuit is usually fixed after the Regulator circuit. Capacitor is mostly used as filter. During the positive half cycle of the AC voltage gets charged and during the negative half cycle it gets discharged. So it allows only AC voltage and doesn't allow the DC voltage. This filter is fixed after the Regulator circuit to filter any of the possibly found ripples within the output received finally. Here we used 0.1µF capacitor. The output at this stage is 5V and the output voltage enters the Microcontroller. The output voltage vanishes when the load is removed or a brief clears. When the load is removing from a switching mode power supply with a LC low-pass output filter, the sole thing the control loop can do is stop the switching action ,thus no more energy is taken from the source. The energy that was stored within the output filter inductor is dumped into the output capacitor causing voltage overshoot.

ARDUINO UNO

GENERAL DESCRIPTION:

Arduino is an open-source project that created microcontroller -based kits for building digital devices and interactive objects which will sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins which will interface to varied expansion boards (termed shields) and other circuits. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) supported a programming language named Processing, which also supports the languages C and C++.

PRODUCT DESCRIPTION

Arduino Uno may be a microcontroller board supported the ATmega328P. Ithas 14 digital input/output pins, 6Sanalog inputs, a 16 MHz quartz, a USB connection, an influence jack, an

- ICSP header and a push button.
- It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter.

Arduino Uno features a number of facilities for communicating with a computer, another Arduino board.

Arduino UNO

APPLICATIONS:

- Real time biometrics
- Robotic applications
- Academic applications

16-2 LCD

GENERAL DESCRIPTION

LCD is abbreviated as liquid crystal show. They are available many sizes 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4,24x2, 30x2, 32x2, 40x2 etc . Many multinational corporations like Philips Hitachi Panasonic make their personal unique form of LCD'S for use of their products. All the LCD'S plays the equal functions (show characters numbers unique characters ASCII characters).Their programming is likewise equal and all of them have same 14 pins (0-13) or 16 pins (0 to 15). Alphanumeric presentations are utilized in a extensive variety of applications, such as palmtop computers,

phrase processors, photocopiers, factor of sale terminals, medical instruments, cell phones, etc.

PRODUCT DESCRIPTION

This is an LCD Display. It is a 16 character, 2-line alphanumeric LCD show linked to a single 9-manner D-kind connector. This permits the tool to be linked to maximum E-Block I/O ports. The LCD show calls for facts in a serial format, that is distinct in the user guide below. The show also requires a 5V power supply.. The 5V is best generated from the E-blocks Multi programmer or a 5V fixed regulated power supply.

The 16 x 2 intelligent alphanumeric dot matrix displays is able to show 224 different characters and logos. A full list of the characters and logos printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specs for connecting the unit, which calls for a single power supply (+5V).

16x2 LCD

D. IoT BOARD V2.0

GENERAL DESCRIPTION:

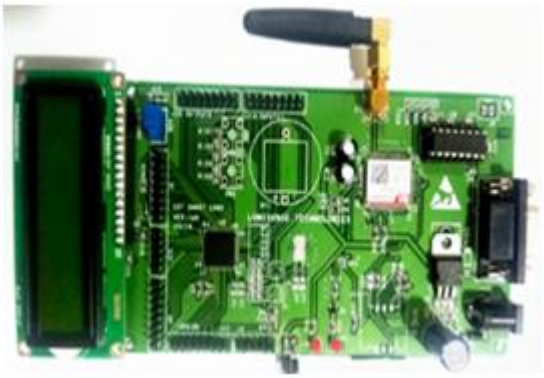
The Internet of Things (IoT) is an surrounding wherein which objects, animals or humans are furnished with precise identifiers and the cap potential to switch facts over a community without requiring human-to-human or human-to-laptop interaction. IoT has advanced from the convergence of wi-fi technologies, micro-electromechanical systems (MEMS) and the Internet. The idea will also be known as the Internet of Everything.

PRODUCT DESCRIPTION

Lumisense IoT board designed to satisfy a lot of online software needs with distinct advantages that allow the embedded machine clothier to easily, quickly and seamlessly upload internet connectivity to their programs.

The module's UART replace characteristic and website manipulate cause them to ideal for online wi-fi programs which includes biomedical monitoring, environmental sensors, and datas from transportable battery operated wireless sensor network devices.

Lumisense IoT board featured with SIM900 GPRS modem to set off net connection also geared up with a controller to technique all enter UART datas to GPRS primarily based totally online facts.



IoT Board

ANDROID DEVELOPMENT

Java because the project is developing an Android Application, the default programming language is Java. Android Studio or Eclipse or both is used to develop android applications. Java may be a popular and widely used language throughout the planet. As mentioned in, Java is one of the powerful programming languages like C, C++. developed by Sun Microsystems which has many powerful features as described below. After the event of C, C++, Java has inherit evolution by addressing their drawbacks. It is one of the open source projects that could be easily installed in our machine. The language is additionally easy to find out, understand and implement. Java is employed in various sort of applications like Web, Desktop, Mobile, and large Data. Application services, graphics library for 2D/3D are all supported by java. The language is flexible enough to take care of code complexity, test, implementation, integration and support. It is object oriented programming language, one among the important hierarchies within the programming languages which is used to implement real time applications, it provides for code reusability, it has a platform independence feature including any virtual machines(Write Once Read Everywhere). It is more secured because the compilers are designed efficiently to work out any quite errors.

IDE's, Tools and Technologies: Android Studio Android Studio is exclusively designed for developing Android applications.

It includes of all Android SDK equipment to design, develop, keep, test, debug and post any app. The IDE is designed correctly that makes the developer's activity easy. IDE additionally helps the IntelliJ IDE, the primary concept at the back of this IDE is that it robotically senses the variables, methods, classes, integrated capabilities or it is able to be something else while we enter the very first letter. Say, suppose we declared few variables or strategies that begins with an 'I', at the very next second automatically senses everything that starts with an 'I' and makes suggestions. It also supports Git as a version control system to take care of the app changes and push them into github. After the completion of project, the entire application might be put as an APK (Android Package) file, during which we will run that APK file entered into any device and use the application. Other important equipment consist of Android SDK, ADB, and Gradle Build. 21

Eclipse IDE Androidpakagesmay be evolved in Eclipse IDE wherein we will compile, run, debug and install the usage of ADT (Android Development Tools).

Eclipse IDE is used to create Java SOAP Web Services for connecting the database and used Android Studio to expand the application. MySQL database to store the data. This is one of the famous open supply relational database control systems. We can carry out allDDL, DML, DCL operations with the use of this database. This additionally helps extraordinary programming language packages. The packages may connect the database with the use of separate methods which incorporates PHP my admin WAMP, LAMP, Web Services. To use this database, we must first download, install and configure the MySQL example in our machine. While configuring, we should provide access credentials which may be used similarly each time you open the MySQL shell.

Apache Tomcat Server is one of the open supply agency Java servlet bins that are broadly used in many packages to hold their database. The database is saved on this far off server and may be accessed each time wished MySQL shell. 24

SOAP Web Services on this utility to attach the utility with database. SOAP Web Services are carried out through writing the carrier as a technique and we need to name this approach in corresponding Android java files, the web page in which we need to name and show the details. The net carrier approach will be examined in SOAP UI through passing the parameters or fields within side the database. The carrier approach returns success if it returns the real end result and fails if it does not. In this manner, we will check the carrier earlier than calling it in Android Java supply files. The UI is very interactive and smooth to use. Security and Permissions in Android Security notions in Android are pretty high. Whenever a brand new Android Application is created, a completely unique user and organisation ID. This makes the upkeep of the utility in an simpler manner to keep away from any protection or privateness issues. As the utility is created uniquely, it turns into personal and nobody can get access to other's programs. Permissions are every other crucial idea that is covered in AndroidManifest.XML configuration file.This is needed if the utility desires to get admission to the outside features. For ex, if the utility desires to access the Internet, Camera or it can be any feature, it calls for permissions. It is covered within side the tags as it is an XML file. Permissions are robotically created for the primary programs at the time when we create the utility. If the app makes use of better stage API or SDK we must explicitly point out the permissions inner makes use of-permissions tag to get admission to the functions or components.

Test Plan and Test Activities Test plan is vital for any mission to plot the trying out segment and determine the scope of the mission.

Test plan entails gathering layout specs approximately the mission, wiring take a look at instances, executing them manually or routinely the usage of computerized trying out tools. Testing any software is exceptionally important. Test plan is a technique of documenting the test cases, specification plans and different simple degree information about how the application works.

Test Activities for this mission consists of diverse testing like:

- Black Box testing: In this mission, pattern take a look at instances are written and guide testing is finished to test the capability of the application.
- White Box testing: Once the software meets the person necessities and functionalities in keeping with the test cases, its internal logic are absolutely examined.
- Unit Testing: All the modules of the software in the program is tested individually by test cases.
- Integration testing: After testing the modules individually, examined them via way of means of integrating all the sub modules, modules into one software.

- System Testing: It refers to checking whether or not the machine where in the software is constructed meets the vital requirements like software program support. It is also checked whether the device in which the application developed is compatible with the software (Android Studio) 26
- End to End Testing: Tested the entire surrounding of software by connecting the device with different machines, installing as an APK file, with the database and in nearby network.
- Usability Testing: Finally, usability testing is carried out by testing the software's flow, UI layout and the way bendy andclan the application is easy to use.

VI. WORKING

The non invasive nano chip is implanted in the molar teeth from which the salivary biomarkers detect the heart attack. When the person faces the myocardial infarction, the salivary biomarkers analyses and the **microcontroller**detects the level of Creatine Kinase**(male<140, female<100)** and concludes whether the person is infarcted or not.

If the person's Creatine Kinase level is high then the database of the person and the person's current location is send through the GPS using Transmitter to the registered mobile numbers and the nearby hospitals (automatic selection by the gps).

REFERENCES

[1] Browne Lisa. 2010. Cardiology part 9, Myocardial infarction, 41–42.
[2] BMC Research Notes 7(1):136 · March 2014 *with* 95 Reads
DOI: 10.1186/1756-0500-7-136
[3] Zimmerman FH, Cameron A, Fisher LD, et al. Myocardial infarctionin young adults: angiographic characterization, risk factors and prognosis (Coronary Artery Surgery Study Registry). J Am CollCardiol1995;26:654–61.
[4] Oral Surg Oral Med Oral Pathol Oral Radiol. 2012 Aug; 114(2): 207–214.DOI: 10.1016/j.oooo.2012.03.003
[5] Role of Salivary Biomarkers in Detection of Cardiovascular Diseases (CVD). DOI: 10.3390/proteomes5030021