*Faculty of Engineering,*

*Alexandria University*

*Graduation Project*

*Initial Proposal*

*IoT integration in healthcare field*

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10. **Introduction**

People are becoming more and more interested in knowing what's going on with their bodies. Devices like smart watches, electronic wrist-mounted biosensors, elder-centered smart hearing aids and other wearable devices have been incredibly spreading all over the world. These devices can measure and gather information about your heart rate, blood pressure, sugar level... etc. Yet, these data is not efficiently used...

We intend to gather all possible medical information about patients on one big database that can only be accessed by the patient himself and his doctor. This information will save a lot of time, money as well as people's lives!

The medical information could help prevent certain diseases before they occur, as an example cancer, As they are always mounted on our bodies, they check for any deficiencies in our cells for example and tells the patient if something is wrong that he has to visit the nearest hospital for that reason.

Another example is preventing blood clotting. Whenever, an error occurs in the blood flow, these devices could send an alarm to the doctor and to the patient to solve the problem before it enlarges. Smart devices can decrease the rate of serious illnesses in a remarkable way.

1. **Past work**

Wearable technologies have evolved from biosensors to smart watches, electronic monitors, smart hearing aids, drug delivery devices and finally VR headset.

The first healthcare devices were those smart watches which helped athletes to keep track of their health by the year 2000. The wearable technology then hit the mainstream in the 2010. In 2011, Google developed the first prototype of what would become Google Glass. The tech giant sent test models to a select group in April 2013 and then released the device to the public in May 2014. Fitbit has released a dozen wearable devices and became so successful by 2015. And finally, Apple released the Apple Watch on April 24, 2015. Integration of IoT with these devices is being studied recently.

1. **Project details**

The project is divided into two main phases:

**Phase One: Sensing Phase:**

In this phase, we are collecting patient's medical data each certain period and comparing these data to a certain ideal level. If these data were not good and indicated that a problem is about to happen, it is directly sent to the hospital database to inform the doctors of his case.

These data could be collected through a series of devices such as:

* Smart watches, worn all daylong which can measure blood pressure, heart rate, sugar rates and others.
* Smart beds which check for any errors occurring during the patient's sleep.
* Wall mounted devices, do the same function of the watch.

The devices needed in this phase are (in general):

* A sensor for sensing different biological information.
* A simple microprocessor for comparing these medical data with the ideal levels and deciding whether to be sent or not to the hospital database.
* A display screen for informing the patient of his health.

The following table proposes different devices and sensors that can be used for this phase. (A device or two from each category will be chosen later for prototyping)

|  |  |  |
| --- | --- | --- |
| Device | Simple description | Components |
| Hand bracelets | | |
| Remotely monitored health monitoring bracelet system | HealthBand is an innovative solution for detecting and locating a person who's health in in grave danger. It is also a smartphone synced mobile health monitoring bracelet capable of reading a human's vital signs. | [ATmega328](http://www.atmel.com/images/Atmel-8271-8-bit-AVR-Microcontroller-ATmega48A-48PA-88A-88PA-168A-168PA-328-328P_datasheet_Complete.pdf)  HC-05 Bluetooth  Lithium battery  temperature sensor  pulse rate sensor |
| IOT Based ICU Patient Monitoring System | It is a Raspberry Pi based system which collects patient’s information with the help of few sensors. It uses Wifi module to communicate this information to the internet. There is this Blood pressure and heart beat monitor module electrically connected to the system and physically to be worn by the user. | Power Supply  Rectifier  Regulator  LCD Display  Temperature and Humidity Sensor  Blood Pressure Sensor  Wifi Module  Raspberry Pi  Resistors-Capacitors-Diode |
| e-Care Heart | E-health Prototype System for Cardiac Tele-monitoring. | Arduino UNO  Genuino UNO  Pulse oximeter  MediaTech labs LinkIt ONE |
| IOT based Patient health monitoring system project | Monitoring various parameters of the patient using internet of things | Arduino UNO  Heartbeat sensor  Temperature sensor  Humidity sensor  LCD display  Buzzer  Wi-fi module |
| SMS based patient health monitoring system project | The primary function of this system is to monitor the 3 health parameters of a patient. We have monitored temperature, Humidity  and Heart Beat of the Patient and the Data collected by these sensors are sent to the Microcontroller. The Microcontroller then transmits the data to the user in the form of SMS. | Micro-controller  Heartbeat sensor  Temperature sensor  Amplifiers  Humidity sensor  ADC  LCD display  GSM modem |
| Gloves | | |
| E-health glove | It detects all your body vitals through various sensors interfaced to it and displays the readings on a small LCD display on the glove. The glove also logs all the data onto Intel's IoT Dashboard. | Edison Board  Libelium Kit Board  Buzzer  Touch sensor  Pulse sensor  Temperature sensor |
|  | **Kits and others** |  |
| IoT based smart healthcare kit | IOT-based health monitoring system for emergency medical services which can demonstrate collection, integration, and interoperation of IoT data flexibly which can provide support to emergency medical services like Intensive Care Units(ICU), using a INTEL GALILEO 2ND generation development board. | Intel Galileo board  Pulse sensor  Temperature sensor (LM-35)  Heart beat sensor |
| IoT Based Health Care System | This is IOT based HealthCare System for monitoring all the body parameters like Heartbeat ,ECG,BP,… plus a mobile app. | Arduino Mega 2650  Arduino WiFi shield  Temperature sensor  Protocentral ADS1292R ECG/respiration shield  ADXL335  Tinycircuits GPS  DHT11 temperature and humidity sensor |
| IOT Based Healthcare System | It is an IoT healthcare device for the patients and doctors. It provides a solution for body parameters measurement like ECG, Temperature, Moisture, and Heartbeat. It also detects the body condition and location of the patients. The mobile application for the patient and doctors contain a very simple GUI Interface for reading all the parameters in the mobile. | Arduino Mega 2560  Temperature Sensor (DS18B20)  Humidity Sensor (DHT11)  Accelerometer (ADXL335)  ECG Module (AD8232)  Ethernet Shield (R911105A)  GPS Module (NEO-6M)  Resistors-Capacitors-IC 7805 |
| Smart mattress | A Smart Mattress eliminates many of the wires associated with current methods and allows for greater flexibility in patient monitoring.  Wireless transmitter is coupled to the electronics unit and send physiological information | Matrix array of plural pressure sensors  Plural row conductors,  Plural column conductors  microprocessor |

**Phase Two: Hospital Database cloud:**

This phase is about a complete database containing all the medical information of the smart city's citizens. This database is important for different reasons:

* Check for current or emerging medical problems.
* Assess the risk of future medical issues.
* Providing a fast medical support whenever a sudden event occurs to the patient. As the hospital shall be smart enough to send an ambulance to the patient at once.
* Whenever a patient visits the hospital all his previous medical data are saved on this database. All the doctor has to do is to access his medical page.

The tools needed in this phase are:

* A good microprocessor to collect and save the huge amount of data and process them, with real time system.
* Communication module as Wi-Fi module, zigbee , Bluetooth ...
* Gateway to address the information that is being sent from devices which aren't connected to the internet.
* Propagating node that contains filtration of the data repeated and rearranges the streaming of the data depending on the priority.
* RFID to identify the patients, which contain all their data.

1. **Future Work:**

**Training Room:**

To ensure good medical treatment, the doctors themselves must be well trained. This could be done through an Interactive Virtual Reality-based training room. The trainee enters the room and starts training on a certain surgery or operation using previously uploaded operations on the VR glasses.

1. **Initial Timeframe:**

|  |  |  |
| --- | --- | --- |
| Time | | Task |
| 5/9 | **11/9** | Searching for exact biomedical devices. |
| 12/9 | **21/10** | Working on phase one; biomedical devices. |
| 22/10 | **2/11** | First term Mid-term exams. |
| 3/11 | **23/12** | Working on phase two; connecting the devices to the cloud. |
| 24/12 | **3/1** | First term final exams. |
| 7/1 | **7/3** | Working on phase three; training section. |
| 24/3 | **7/4** | Second term Mid-term exams. |
| 8/4 |  | Writing the book and presentation. |
|  |  | Second term Final exams. |
| Summer | **Vacation** | Project discussion. |

1. **Prices:**

"Initial budget will be determined according to the devices to be chosen"

|  |  |  |
| --- | --- | --- |
| Component | | Cost |
| Remotely monitored health monitoring bracelet system | ATMega328 – With Bootloader for “ARDUINO UNO” | 50 LE |
| Bluetooth Module v4.0 (Android&IOS HM-10 BT) | 150 LE |
| Lithium Polymer Battery (11.1 V, 3300 mAH- 35C) | 545 LE |
| Temperature Sensor Module KY-028 | 25 LE |
| Pulse Heart Rate Module | 100 LE |
|  |  | **870 LE** |
| IOT Based ICU Patient Monitoring System | Power supply 24V -20ATop of Form | 400 LE |
| Bridge Rectifier 1A DB107S SMDTop of Form | 2 LE |
| Regulator 78M05 SMDTop of Form | 3.5 LE |
| LCD Module and Controller for 3D PrinterTop of FormBottom of Form | 185 LE |
| Digital Temperature and Humidity Sensor DHT22 | 105 LE |
| [Blood Pressure Sensor Module](https://store.fut-electronics.com/products/blood-pressure-sensor-module) | 100 LE |
| WiFi ESP8266-12-E Serial TTL Module | 70 LE |
| Raspberry Pi 2 Model Bi | 495 LE |
| Resistors-Capacitors-Diode | 20 LE |
|  |  | **1380 LE** |
| IOT based Patient health Monitoring system project | Arduino UNO SMD | 110 LE |
| Pulse Heart Rate Module | 100 LE |
| Digital Temperature and Humidity Sensor DHT22 | 105 LE |
| LCD Module and Controller for 3D PrinterTop of FormBottom of Form | 185 LE |
| Buzzer Alarm 3-24V 95DB | 12 LE |
| WiFi ESP8266-12-E Serial TTL Module | 70 LE |
|  |  | **582 LE** |
| SMS based patient health monitoring system project | Arduino UNO SMD | 110 LE |
| Pulse Heart Rate Module | 100 LE |
| Digital Temperature and Humidity Sensor DHT22 | 105 LE |
| LCD Module and Controller for 3D PrinterTop of FormBottom of Form | 185 LE |
| Amplifiers | 20 LE |
| ADC0808 8 bit A/D Convertor with 8-Channel Multiplexer | 35 LE |
| [GSM-GPRS Module](https://store.fut-electronics.com/products/gsm-gprs-module) | 830 LE |
|  |  | **1385 LE** |
| IOT Based Healthcare System | Arduino Mega 2560 | 420 LE |
| Temperature Sensor (DS18B20) | 35 LE |
| Humidity Sensor (DHT11) | 45 LE |
| Accelerometer (ADXL335) | 65 LE |
| ECG Module (AD8232) | 20$ ~ 360 LE |
| Ethernet Shield (R911105A) | 185 LE |
| GPS Module (NEO-6M) | 390 LE |
| Resistors-Capacitors-IC 7805 | 15 LE |
|  |  | **1515 LE** |
| IoT Based Health Care System | Arduino Mega 2650 | 420 LE |
| Arduino WiFi shield | 360 LE |
| Temperature sensor | 35 LE |
| Protocentral ADS1292R ECG/respiration shield | 51.13 $ ~1200 LE |
| ADXL335 | 65 LE |
| Tinycircuits GPS | 390 LE |
| DHT11 temperature sensor | 35 LE |
| Humidity sensor | 45 LE |
|  |  | **2550 LE** |
| IoT based smart healthcare kit | Intel Galileo board | 70 $~1350 LE |
| Heart beat sensor (pulse sensor) | 145 LE |
| Temperature sensor (LM-35) | 20 LE |
|  |  | **1515 LE** |
| E-health glove | Edison and Libelium Kit Board | 75$~1450 LE |
| Buzzer | 6 LE |
| Touch sensor | 130 LE |
| Pulse sensor | 145 LE |
| Temperature sensor | 35 LE |
|  |  | **1766 LE** |
| Smart mattress | Matrix array of plural pressure sensors : | n\* 1000 LE |
| Plural row conductors | m\*5 LE |
| Plural column conductors | l\*5 LE |
| Microprocessor (raspberry pie ) | 495 LE |
| VR Glasses | | 30 ~ 300 LE |
| Total | | 1000 LE – 3000 LE |