

Healthcare Digitalization Upgrade

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Abstract

The project has been created with the intent to upgrade hospitals to the next level, by incorporation of digital advancements to the healthcare-patient interface that increase sanitation, safety, and patient awareness on medication usage with easy access to expiry dates.

This hospital upgrade will provide three features: (1) A QR code based pharmaceutical system (2) An app with AR based “No-contact” virtual switches (3) AI based mask detection at hospital entrance

Keywords: Healthcare, Patient awareness, Patient Safety, Preventing Disease spread, Expired medicine, QR code, Mobile Application, No Contact, Augmented Reality, Artificial Intelligence, Mask detection, Digital healthcare upgrade.

INTRODUCTION

- In Healthcare, the focus of importance is to the patient, but even then apart from providing treatment to the patient, sometimes we tend to underestimate the importance of the patients understanding of what is happening. This can lead to many issues that affects the patient themselves.
- For example, a layman would not understand the implications of taking a certain medication or its side effects, unless it was explicitly told to them. Due to this there have been many cases where people tend to overdose on certain medications accidentally.
- Keeping track of expiry dates of each medication is also cumbersome, especially as when a tablet strip is cut, many times the expiry
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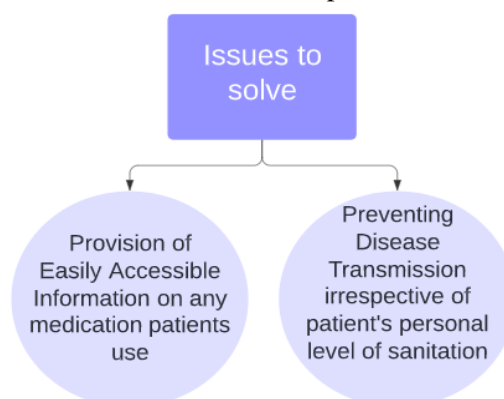
date is no longer readable, this can lead to life threatening situations, if the patient consumes expired medicine.

- Apart from this they might not understand the importance of certain safety measures such as wearing a mask, or keeping their hands sanitized at all times which could put both them and others in danger.

OBJECTIVES:

From the points discussed above, we need Upgrade our Hospital Systems in such a way that:

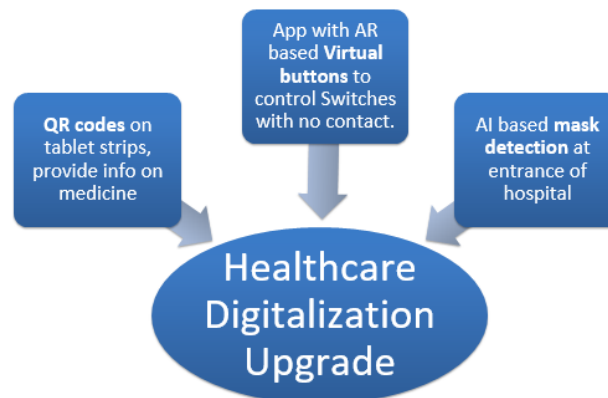
1. We depend less on the patient's individual awareness of sanitary measures, and can ensure safety for all.
2. Find a means of creating very easily accessible information on the medication that patients use.



SOLUTION AND APPLICATION:

We can solve these issues by implementing a healthcare digitalization upgrade package that we have created, in hospitals all over the world.

It introduces the following digital upgrades, in an existing hospital:



1. A QR CODE BASED PHARMACEUTICAL SYSTEM:

where details on each tablet and its side effects can be retrieved by scanning a QR Code on the back of the tablet strip. This also allows ease of access to the expiry dates of medicines even on strips that have been cut into smaller strips, as multiple copies of the code will be printed on each strip.

2. AN APP WITH AR BASED “NO CONTACT” VIRTUAL SWITCHES:

where the user only needs to touch a virtual switch seen in the air through their phone camera without actual physical contact. These enable contactless operation of switches in the hospital, such as elevator buttons, fan and light switches. This will significantly lower the chances of disease spread.

3. AI BASED MASK DETECTION AT HOSPITAL ENTRANCE:

based on which unmasked people can be prohibited from entering the building. This ensures that the chances of disease spread in the hospital through coughing and sneezing are lowered as far as possible.

SOFTWARE AND HARDWARE USED:

1) QR code based pharmaceutical system:

- Go medic app (designed by us)
- Medic app (designed by us)
- Firebase database
- QR code generator

2) AR based “no contact” virtual buttons:

- Unity App
- Medical AR app (designed by us)

3) AI based mask detection at hospital entrance:

- Arduino
- Relay
- Led lights

- P5. console editor
- Serial communication app

METHODOLOGY AND SYSTEM DESIGN

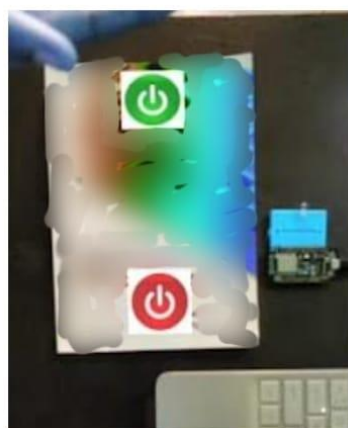
1) QR code based pharmaceutical system:

- This Feature enables the user to scan a QR code on the back of the tablet strip that has been printed for each individual tablet.
- After scanning the code, the application retrieves data about the purpose and the side effects of the medication, along with its manufacturing and expiry date.
- The data is entered into the database by medical professionals through a secondary application.
- A working prototype has been created for this concept, which works as described below:
 - a. On opening the application, there is a button called “scan” at the center
 - b. On clicking the “scan” button, a QR code scanner is opened and the code is scanned by the user. Using the code, data is retrieved from the database.
 - c. The details of the medication appear on the bottom panel once the data is retrieved.
- The prototype was created using Firebase for storage and access of the data, and with

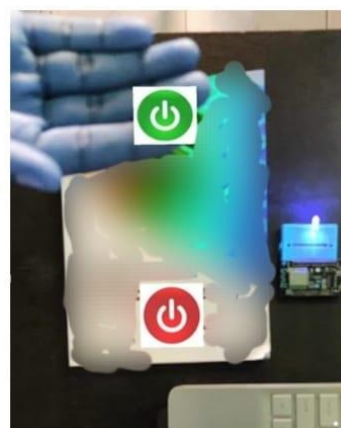
2) AR based “no contact” virtual buttons:

- These enable contactless operation of switches in the hospital, significantly lowering the chances of disease spread.
- There will be an application available for mobile phones, through which a user can view his surroundings through the camera of their phone.

- When the camera detects a pre-set target image, it displays a set of virtual switches on the user's screen that appear to hover over the target image.
- We have created a working prototype of this concept, where textbook cover has been taken as the target image.



On waving hand under virtual "ON" button the LED switches ON



- c. When the user swipes their hand in the air in such a way that they appear to touch the virtual "ON" button, the LED switch turns ON.

- We have implemented this prototype with the help of Arduino, Node MCU, Unity Editor, and Vuforia Engine.

3) AI based mask detection at hospital entrance:

- This feature allows the hospital to add an extra measure of safety.
- It is the idea to include AI based mask detection at the entrance of the hospital.
- The system would recognize whether a person is wearing a mask, and create a corresponding output that expresses the same.
- This output can be utilized as per requirement by the hospital for the required action that they wish to do with the knowledge of whether the person is wearing a mask or not. For example ask for a fine, prohibit them from entering, automatically lock and unlock the door, etc.
- We have created a working prototype for mask detection.
 - a. The system detects a person wearing a mask, and returns the output 1 to the console.
 - b. If the person is not wearing a mask it returns the value 2 to the console.
- We have done this with a dataset model using teachable machine that was integrated with Arduino.

- a. The pictures given below are what appears on the phone screen, when the camera detects the target image. (The textbook cover has been blurred for copyright reasons).
- b. As seen below, two virtual buttons, one red and one green, appear over the target image (textbook cover) that is viewed through the camera.

OBJECTIVES

To provide a digital upgrade to the healthcare-patient interface such that:

The patient is also aware of why they consume each medicine, and the risks of overdose, and potential side effects of the medicine, and there is also easy access to expiry dates on medication, particularly as tablet strips are cut into smaller strips quite often, resulting in the expiry date being cut off, and no longer visible.

ADVANTAGES

1) QR code based pharmaceutical system:

- Patient is aware on why they are taking each medication, and what it is treating.
- Awareness on risks of overdose for any medicine.
- Patient need not look up complex medicine names to learn more about it on the internet.
- More safety to patient lives as reduced risk of accidentally taking expired medicine.

2) AR based "no contact" virtual buttons:

- Surface-contact based transmission of diseases is avoided.
- Patients with communicable illnesses have significantly less chances of transmitting diseases to doctors and other patients.
- Easy to operate

3) AI based mask detection at hospital entrance:

- Aids hospitals in automating the process of recognizing those who are not wearing masks
- Chance of spreading airborne diseases is reduced.
- Less hospital staff required at entrance of hospital, meaning less crowding, and more social distancing is possible.
- Hospital can take required actions with the information on whether masks are worn, such as levying fines, prohibiting entry, providing free masks and so on. The choice of what action to take is left to the will of the hospital.

LIMITATIONS

- Widespread implementation of QR code based tablet packaging is required to make a significant change in the present pharmaceutical system.
- Virtual button implementation requires a small physical installation at hospital, at required points.
- Despite automated mask detection being done, a staff personnel is required to be present at the entrance to carry out the required action that the hospital decides on such as prohibiting entry, charging a fine or providing free masks.

CONCLUSIONS

In conclusion, the implementation of this digital upgrade to the healthcare system would benefit patients and provide greater safety to their lives, as the risk of consuming expired medicine is greatly reduced, as is the risk of disease spread through surface contact through switches, and coughing and sneezing without a mask.

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