

UBIQUITOUS COMPUTING REPORT

SMART NICOTINE PATCH WRISTBAND

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ABSTRACT

The Main Objective of Quit Smoking is to develop a Technological solution with minimal Manual Intervention to help Tobacco/ Cigarette users to Curtail the Habit of smoking using Concepts of Nicotine Patch on a Smart Wearable device with Live Cartridge Monitoring, personal counsellor for advice and help the user through the de-addiction process via a mobile application interface through the User's phone.

INTRODUCTION

Nearly a Billion people smoke cigarettes across the world I.e 20% of the world's population smoke cigarettes and among these people about 69% of the smokers would like to quit smoking or have had a failed attempt at quitting. The Average medical cost incurred by the government and people in US alone due to smoking related diseases is around \$333 Billion and this addiction takes nearly 50,000 lives per year.

Currently, there are many solutions available in the market which must be administered manually or it requires the user's mental strength for achieving themselves a smoke free life. There are also a few technological solutions available i.e Motivational Applications on the phone but they are not very effective in helping the user as they rely solely on the user's input.

We would like to develop a solution on helping people kick the butt using technology which can overall integrate the manually administered patch and the technologically equipped Application on the phone thereby, reducing the manual effort and manual input and reduce the mistakes that people make while trying de-addiction from cigarettes. Cigarette Smoking kills Nearly 50,000 People a year.

RELATED WORK

Nicotine Patch

A nicotine patch is a transdermal patch which releases nicotine to the body through the skin and is a very famous solution for smoking cessation and is advised by many therapist to their clients to help them quit smoking. The patch must be manually administered by the user onto their skin. Nicotine patches are available in various quantities such as 12,21mg per patch as the amount of nicotine available in the patch for use. Nicotine solution or a 21-mg patch roughly takes around 16 hours for it to completely seep into the skin of the user and it has known side effects like Itching and if the nicotine administered is of a high dosage than required it can cause severe headaches and Nausea. It is also a known fact the nicotine patches have ingredient called TSNA or Tobacco- specific Nitrosamines which can cause cancer in many users who use the path frequently. Using the patch can help to reduce withdrawal symptoms when you quit, such as cravings, irritability and difficulty concentrating



The Metrics for nicotine patch show it has a very low success rate of 15%. And in recent studies it is found that most people who use nicotine patch relapse within 24 weeks of their first use.

Products on Market: NIcoDerm, Nicorette

E-cigarettes / E-vapes

Electronic cigarettes are devices which run on a rechargeable battery which has a cartridge or a tank which houses the Nicotine liquid and has heating panel to vaporize the liquid on suction by the user. E-Cigarettes are an effective way of achieving a smokeless life as it helps the user reduce the craving for cigarettes. The liquid in the e-cigarette, called e-liquid, is usually made of nicotine, propylene glycol, glycerin, and flavorings.

When used by non-smokers, e-cigarettes can lead to nicotine addiction and starting smoking. no serious adverse effects have been reported in trials. Less serious adverse effects include throat and mouth irritation, vomiting, nausea, and coughing. Recently it also found that the e-cigarettes explode and tend to cause serious injuries to the user.

There is a 30% chance of users permanently quitting smoking as compared to Nicotine patch which has a 15% chance of success. But as mentioned above the adverse side-effects on the excessive use of e-cigarettes are unknown and yet to be found. But overall, this method of smoking cessation also involves the user's motivation on whether he gives up smoking and not solely based on the device.



Chantix and Zyban

Two medicines that do not contain nicotine are Chantix (varenicline tartrate) and Zyban (bupropion hydrochloride). Both are available in tablet form on a prescription-only basis in the market. The drug both reduces cravings for and decreases the pleasurable effects of cigarettes and other tobacco products. Through these mechanisms, it can assist some patients to quit smoking.

The side effects of Chantix are Mild nausea which can be seen in approximately 30% of people taking varenicline. Other less common side effects include headache, difficulty sleeping, and nightmares. Rare side effects reported by people taking varenicline compared to placebo include change in taste, vomiting, abdominal pain, flatulence, and constipation.

The success rate for the prescription-based tablet is only 14%.

Quit Smoking Application

This is Mobile Application available on all platforms. There are no side effects to this method of treatment as it does not involve any drug. The Application is solely dependent on the user input on how many cigarettes he/she has smoked through the day and it gives a feedback and projects motivational images and videos on the phone/tablet if the user encouraging them to put smoking.



The Problem with a sole functioning mobile app is that it can be duped by the user on how many he/she smoked and the application trusts the user feedback. However, smoking cessation is still up-to the user on whether he really is determined to stop smoking or not.

So, this application only plays a passive role in supporting a user's decision on trying to quit the habit of smoking and does not have any active indulgence or effect on the user and his habits.

PROPOSED SOLUTION - SMART NICOTINE REPLACEMENT WRIST BAND

Overview

Smart Nicotine Replacement Wrist Band Automates the administration of the nicotine patch and will help to overcome the current manual nicotine administration problems such as Washing the hands after applying or removing the patch, applying a new patch at the same time each day and to be sure to use a different skin site to avoid skin irritation and many problems which makes the use of nicotine patch a tedious task. The wrist band automates the manual nicotine patch process and the continual wear of the wrist band during the first few weeks (night and day) will reduce the nicotine craving level.

Working Principle

Every day, add a new nicotine cartridge to the device, and through the smartphone app, we can set Wake up time, a time it should start administering the nicotine patch to the skin. The cartridge contains nicotine in solution form, and the wristband device applies this solution to the skin as required by the user (with prior advice from the physician), varying the doses according to how quickly the solution evaporates.

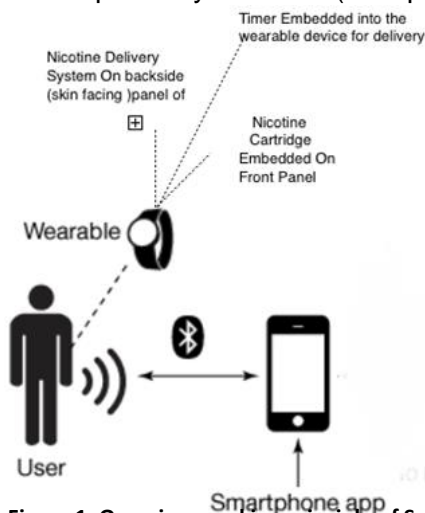


Figure 1. Overview working principle of Smart Nicotine Replacement Wrist Band

Adding up with sensors which should detect when the device is in contact with the skin and whether the cartridge is properly installed or not. The device starts out by administering a high-dose nicotine, and then, as the week's pass, it will reduce the amount of nicotine sent to the skin until they reach zero.

In addition to that, the smartphone app shows users how much of the drug they're getting and when they're getting it. It should also be water-resistant, so it can be worn in the shower or at the time of any physical exercises. It also provides push notifications to alert the user if they aren't properly wearing the device, when they need to change the cartridge, and in the event of other issues. Users can also alert the system when they get a new craving, with the app responding accordingly.

CHATBOT

Chat bot is an application embedded in many applications like Facebook, slack etc. which helps in conversing with users. Our chatbot is designed in a way to provide the user with functionality

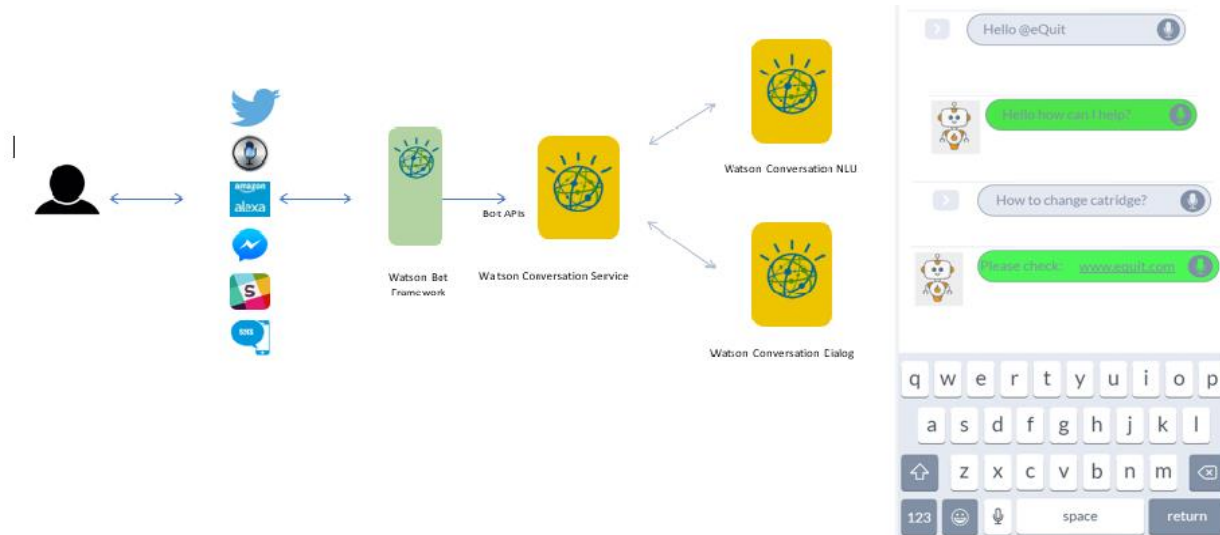


Figure 2. Chat-bot design model and Chat-bot user interface sample

of conversing with a therapist if user faces any issues regarding the device or needs any help in while trying to quit smoking or in any case the user feels the urge of a relapse after or during the treatment .

Nowadays, building a bot is not a hard task .we can use the available bot framework, and train the bot conversation using our content. We plan to develop the chat bot using IBM Watson BOT framework. We use this framework because it provides tools to design a chat bot and is easy to connect to IBM conversation service using an API.

IBM also provides Conversation Services called Watson Conversation Service. There are two type of API's available:

1. Watson Conversation natural language understanding (NLU) – turn text into meaning (intent, entities), for example we can turn this text:
 - Where I can buy nicotine cartridge model A713
 - Intent: Replace cartridge
 - Entity: model A713
2. Watson Conversation Dialog - It is rule based domain specific language for scripting responses
 - If #get_alarm and @color:Red
 - Say “unlively” – “empty nicotine”

Our Bot can be plugged in to multiple Virtual Agents (VA). The ability for to be plugged to VA is important because we have already billions user on Facebook Messenger or Slack, it will be easy to connect our users using these channels.

EVALUATION METHODOLOGY

We intend to conduct a survey on 60 volunteers who have the habit of smoking and who are willing to quit. and We group them in to two phases:

Treatment group

This Group will contain 40 volunteers and will be using the device prepared by us.

Control Group

This group will have 20 volunteers and will reusing the traditional Nicotine de-addiction processes like the nicotine patch or e-vapes.

From the above 2 groups formed we intend to collect data to improve the effectiveness and the efficiency of our device.

We will be collecting the user reports on the effectiveness of both treatments by assessing their withdrawals symptoms, the ease of use and the percentage of permanent quitters from each treatment group and compare the success rate of the two.

SURVEY AND EVALUATION PROCESS

We plan to design a mobile app to conduct surveys from study matter. Users will be asked to provide feedback through survey 5 times a day on average ,3 times being mandatory on scheduled intervals (example: 9AM,12AM,4PM) and 2 other surveys may be conducted in random intervals of time. Users need to provide feedback on their urge to smoke while being on the treatment cycle. Users will also be asked to rate the urge of smoking on a scale of 1 to 5 and the how or when the urge was controlled or triggered. In case they smoked a cigarette while on treatment they will have to input that information onto the survey. Below are a Few sample questions to gather information on a user's urge to smoke.

Questions	Rating
Did you smoke today ?	YES / NO
How Many cigarettes Did you Smoke	VALUE (Number).... (If the previous question is yes)
Do you currently have a cigarette pack on you ?	YES / NO
What was the reason behind you smoking ?	VALUE
Did You Meet your friends today and smoke ?	YES / NO
Did you have a smoke after your Breakfast/Dinner / Lunch	YES / NO

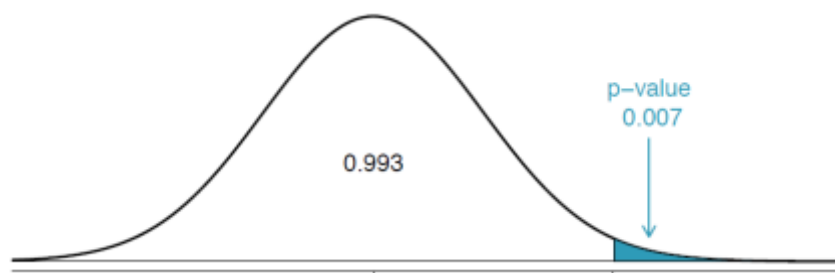
Time	Morning/Lunch/Afternoon
Coffee	Are you drinking coffee?
Alcohol	Are you drinking alcohol?
Cigarette available	Do you have cigarette around?
Friend smoke	Do any friend smoke around you?
Location	Home / Work / another place
Stress	Do you stress?
Happy	Do you feel happy or existing
Alone	Are you alone ?

We will calculate the mean, standard deviation for each contextual items collected through the user surveys and compare the two solutions by using Hypothetic Testing method. We can set up the null hypothesis for this test as a perspective: our solution average value should be better than that of the nicotine patch. We can write these hypotheses as

- H_0 : Average value of our solution < average value of nicotine patch (user's manage the urge to smoke better by using our device)
- H_a : Average value of nicotine patch < average value of our solution

Based on mean, standard deviation value of each solution we can build the paragraph of possible value P of Reject H_0 . If the P value < 0.05 we can accept H_0 .

We have not set a bench mark yet. But, we can treat the objective of our solution success if it is 70% better than the contextual matter.



Survey on Usability of device

The feasibility of using the device created by us should also be measured as this device involves with the reduction of manual effort on comparison to other solutions in the market. A survey will be conducted after 6 weeks of treatment asking the users to rate the usage of device and the traditional patch therapy.

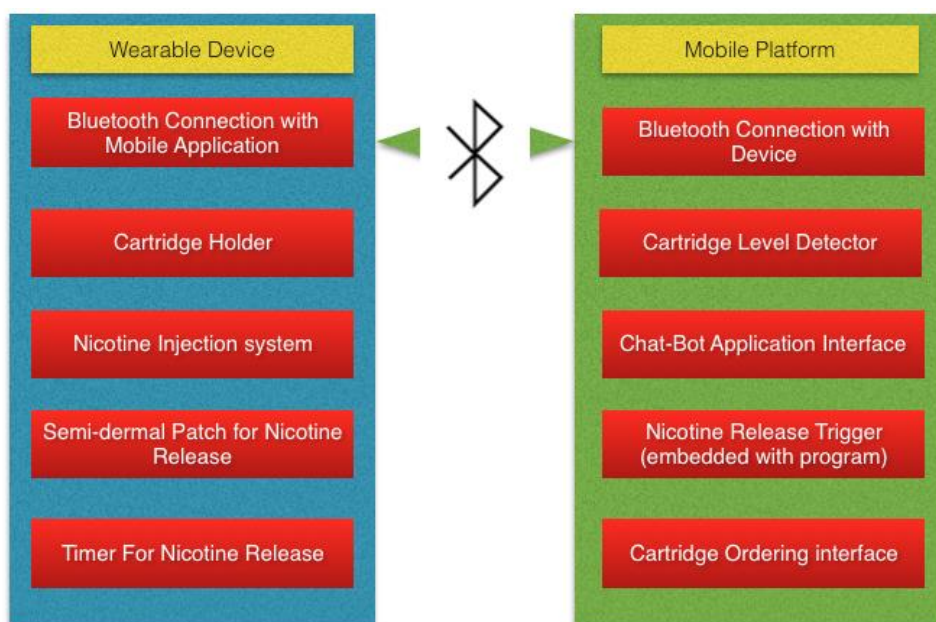
Questions	Rating
Have you tried Nicotine Patch before using this device	YES / NO
Did the device Malfunction at any course of the treatment?	YES / NO
How many times on an average did the cartridge need to be replaced during treatment ?	VALUE
Did the device leave any irritative skin lesions or marks on you ?	YES / NO
Did you permanently quit smoking upon using the device	YES ? NO
Was the Mobile Application helpful ?	YES / NO
How did you find the chatbot?	GOOD / AVERAGE / EXCELLENT
Would you recommend the device to any friend or people ?	YES / NO

PROTOTYPE DESIGN



LINK:

<https://marvelapp.com/project/1913163/>



HARDWARE PROTOTYPE

COST OF DEVELOPING A PROTOTYPE AND TESTING:

BLUETOOTH CHIPSET : \$ 15

MOBILE APPLICATION DEVELOPMENT FOR PLATFORMS (IONIC) : \$50

WEARABLE DEVICE : \$150

COST SURVEY : \$50 FOR 6 WEEKS PER PERSON.

MINIATURE INJECTION SYSTEM : CND. (Cost no decided)

SEMI-DERMAL PATCH FOR WEARABLE DEVICE: CND. (Cost no decided)

NICOTINE CARTRIDGE : CND (Cost no decided)

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