

Harmful Rays Detection and Skin cancer prediction App

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- **Abstract**

The sun sends energy to Earth in a few different ways: In addition to visible light that you can see, the sun also emits infrared radiation that you can feel as heat and ultraviolet radiation that you cannot see or feel. Fortunately, the atmosphere of the Earth protects us from the majority of UV radiation. While some sun exposure is necessary for our bodies to produce vitamin D but too much UV radiation is harmful. There are three types of UV rays:

- **Ultraviolet A rays (UVA)**

- The atmosphere does little to shield these rays—most UVA radiation reaches Earth's surface.
- UVA rays cause skin aging and eye damage, and can lower your body's ability to fight off illness. UVA rays also contribute to the risk of skin cancer.

- **Ultraviolet B rays (UVB)**

- The Earth's atmosphere shields us from most UVB rays—the amount of UVB rays that reach the Earth's surface depends on latitude, altitude, time of year and other factors.
- UVB rays cause sunburns, skin cancer, skin aging, and snow blindness (a sunburn to your cornea that causes a temporary loss of vision) and can lower your body's ability to fight illness.

- **Ultraviolet C rays (UVC)**

- UVC rays do not reach the Earth's surface because they are completely absorbed by the atmosphere.
- Harmful effects from UVC rays are minimal.

The majority of UVA and some UVB radiation that reaches the Earth's surface. Between 10 a.m. and 4 p.m., over half of the day's total of the more dangerous UVB radiation is absorbed. UVB rays may cause sunburns even on overcast days.

The most prevalent type of cancer in the country is skin cancer. Although everyone should use sun protection, children should be given special consideration. Before the age of 18, the average individual is exposed to the majority of the sun's UV rays. In especially during infancy, excessive UV exposure and repeated sunburns might increase the risk of getting skin cancer.

- **Problem Statement**

The harmful rays emitted by Sun, such as Ultraviolet rays (UV radiation) can have negative impact on human health, including premature aging, sunburn and it may also lead to skin cancer. To protect people from these harmful rays, we can create an application that uses machine learning algorithms to identify and warn users about dangerous UV radiation levels and it will also predict skin cancer of the user. The idea, execution and potential benefits of such harmful rays detection and skin cancer prediction app are explored in this report.

- **Market/Customer/Business Need Assessment**

The emission of harmful rays by the Sun, such as ultraviolet rays, is due to the depletion of the ozone layer around the Earth. The ozone layer is present in the Earth's atmosphere, it absorbs and filters harmful rays from the sun and acts as a protective layer. The main reason for the depletion of the ozone layer is some man-made gases such as halons, methyl chloroform, chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). These gases are present in electrical appliances like refrigerators, air conditioners etc. Due to the increase in population and atmospheric temperature, there is a high demand for these electrical appliances and this increases the rate of ozone layer depletion, which increases the risk. Increasing effects of ultraviolet rays leads increasing patients of skin cancer, sunburn etc. So, by using this harmful rays detection and skin cancer prediction app technology, we can reduce the effect of ultraviolet rays and will be useful for all users.

- **Target Specifications and Characterization**

This app will provide users the real time intensity of harmful rays which will help users to manage their schedule for outside work and will decrease the effects of harmful rays.

Following are some useful functions of this app:

- It will use machine learning algorithm that will collect and use data from various sources, such as history of intensity of UV rays in that geographical location, real time weather etc.
- App will alert users by real time notifications of intensity of harmful rays and their level of threat so users can use protection before going outside such as Sunscreen, umbrella etc.
- Each person has different type of skin so, there will be different level of threats for same intensity of harmful rays. This app will give Users some features which will allow users to input their skin type and their health condition based on their data this app will provide suitable method for each user.
- App will also allow users to input their current health condition and it will predict whether user have skin cancer or not.

- **External Search**

The sources I have used as reference for analysing the need of such system (App) which will be useful for everybody are:

- <https://onlinelibrary.wiley.com/doi/10.1111/jocd.14120>
- <https://www.cnet.com/health/personal-care/dont-believe-these-10-sunscreen-myths-and-save-your-skin/>
- [https://www.epa.gov/radtown/ultraviolet-uv-radiation-and-sun-exposure#:~:text=Too%20much%20ultraviolet%20radiation%20\(UV,be%20sunburned%20by%20UV%20radiation.](https://www.epa.gov/radtown/ultraviolet-uv-radiation-and-sun-exposure#:~:text=Too%20much%20ultraviolet%20radiation%20(UV,be%20sunburned%20by%20UV%20radiation.)
- https://www.researchgate.net/publication/338587506_IoT_System_for_Ultraviolet_Ray_Index_Monitoring
- <https://appinventiv.com/blog/top-legal-issues-in-mobile-app-development/amp/>
- <https://www.nerdwallet.com/article/small-business/what-is-a-business-model>
- <https://www.alliedmarketresearch.com/digital-health-market-A10934>

- **Applicable Patents**

- [Dynamic, real time ultraviolet radiation intensity monitor](#)
- [Mobile device based ultra-violet \(UV\) radiation sensing](#)

There are many patents available but since above two are a lot similar to what I proposed in my Harmful ray detection application, So I have only mentioned them.

The first patent describes in detail the working of Dynamic, real time ultraviolet radiation intensity monitors as I mentioned in my application function. It describes how optical fiber is connected with radiation sensor and with the help of FDC system it provides real time intensity of ultraviolet radiation.

The second patent describes in detail how Mobile device can be manufactured based on Ultra-violet (UV) radiation sensing. This patent discloses device and system embodiments that address mobile device integration considerations for various categories of UV sensors, including cameras, photodiodes, and chemical sensors. The UV sensors may use the functionalities of the existing in-built sensors in conventional mobile devices, and/or integrate additional components specific to UV sensing. By optimally positioning the sensors, UV sensing and other collateral functionalities (e.g., charging a photovoltaic cell integrated with the mobile device) can be realized in parallel.

- **Applicable Constraints**

- This is an application so, it will require no real space.
- It will continuously collect the data from the weather and geographical condition.
- Privacy Policy in place for users and clients to describe how we use and process their personal data. The Privacy Policy explains what happens to any personal information that user provides to us, or that we collect from users while user use our application. It will collect data from the users about their health condition and skin type.
- The budget of this application includes the App development, Machine learning engineer, IOT system engineers etc.

- **Applicable Regulations**

- Confidentiality agreements to protect app ideas from possible stealing or competition. Confidentiality issues may arise in a scenario where we outsource third parties. A Non-disclosure agreement (NDA) is considered the most familiar way to protect product ideas.
- Intellectual property (IP) relates to all work that is original and created during the app development process. During the app development process, the team will create legal app ideas, original content, designs, logo, app names etc. These all-original elements are considered IP and belong to the owner. So, company needs to register them as trademarks, copyright, or patents to protect the app idea.
- After the development of application, Application should follow all the government guidelines and should also follow government regulation for application distribution.

- **Business Model**

A business model spells out how a business will generate revenue. A business model is an outline for how your company plans to make money. In general, a business model explains four things:

- What product or service a company will sell.
- How it intends to market that product or service.
- What kind of expenses the company will face.
- How the company expects to turn a profit.

In this application we will implement Subscription Model.

A subscription business model can be applied to both traditional brick-and-mortar stores and e-commerce businesses alike. Essentially, the customer makes a recurring payment for ongoing access to a service or product. A company may directly ship its product in the mail, or you may pay a fee to use its services.

There will be two types of accounts in this application normal and subscription based.

➤ Normal Account:

In this there will be available normal feature of application such as It will show Intensity of Ultraviolet radiation of that day. It will generate profit by showing advertisement to the users and to remove advertisement user will have to buy subscription.

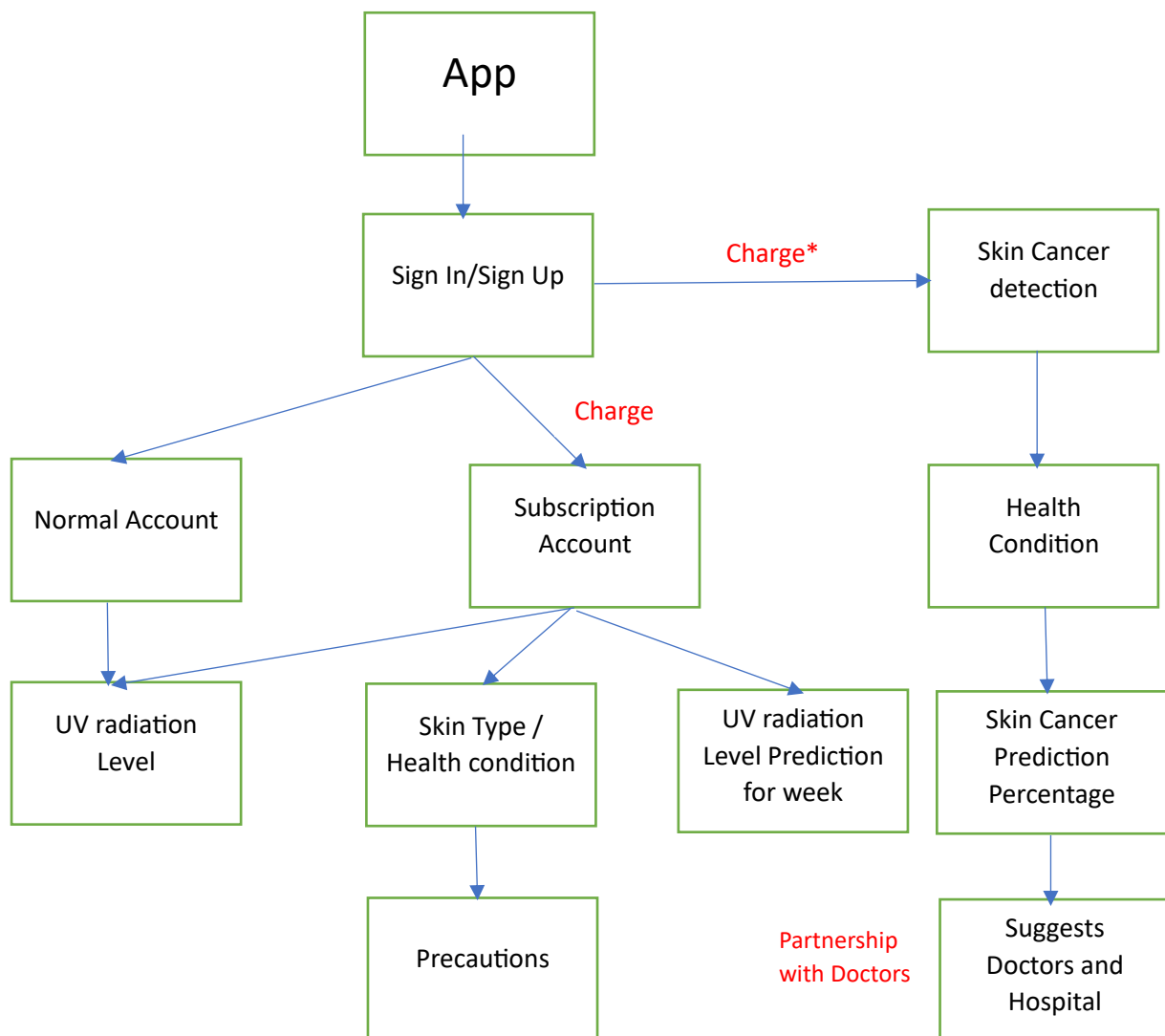
➤ Subscription Account:

It will allow many features such as Intensity of Ultraviolet radiation of that day, prediction of Intensity of Ultraviolet radiation for another day, precautions of radiation based on user health, etc. As it is a subscription account there will be no advertisement but it will generate profit from subscription amount.

Both the accounts will allow the users to know their health conditions whether they have skin cancer or not but it will take some fee. Medical tests are very expensive, so when a person has a disease and wants to know whether it is dangerous skin cancer or not, the cost will be very high. Many people do not get tested for their disease because of the cost of medical tests. This will allow users to test their disease with very small amounts and predict

whether they have skin cancer or not. If the prediction is high then they may visit the hospitals and if it is low then they will not visit the hospitals. For such patients, we can partner with hospitals or doctors and take some commission from the doctors

- **Final Product Prototype**



Above diagram shows the Final prototype of Product, Following are some explanations:

➤ **Sign In/Sign Up:**

To use this application users, need to create an account using their mobile number or email id. The sign in/sign up page will also include some option for social media like Gmail, Twitter, Facebook etc. so that they can directly use that option to create their account. We will be using some APIs to access this feature so that we can directly grab users' credentials from their social media accounts.

➤ **Normal Account:**

This type of account will not charge users any fees and will only allow users to view current time UV radiation levels. It will show some ads to the users to make profit.

➤ **Subscription Account:**

This type of account will charge some fee from the users and it will allow the users to forecast the current time UV radiation level as well as UV radiation level for the coming days. It will also suggest users some precautions for high UV level as per their skin and health condition.

➤ **Skin Cancer Detection:**

It will be available in both normal and subscription accounts and will predict the likelihood of skin cancer based on the user's entered health status.

But it will charge some fee from both Normal and Subscription account users. After prediction it will suggest names of some doctors and hospitals for the users.

- **Financial Equation**

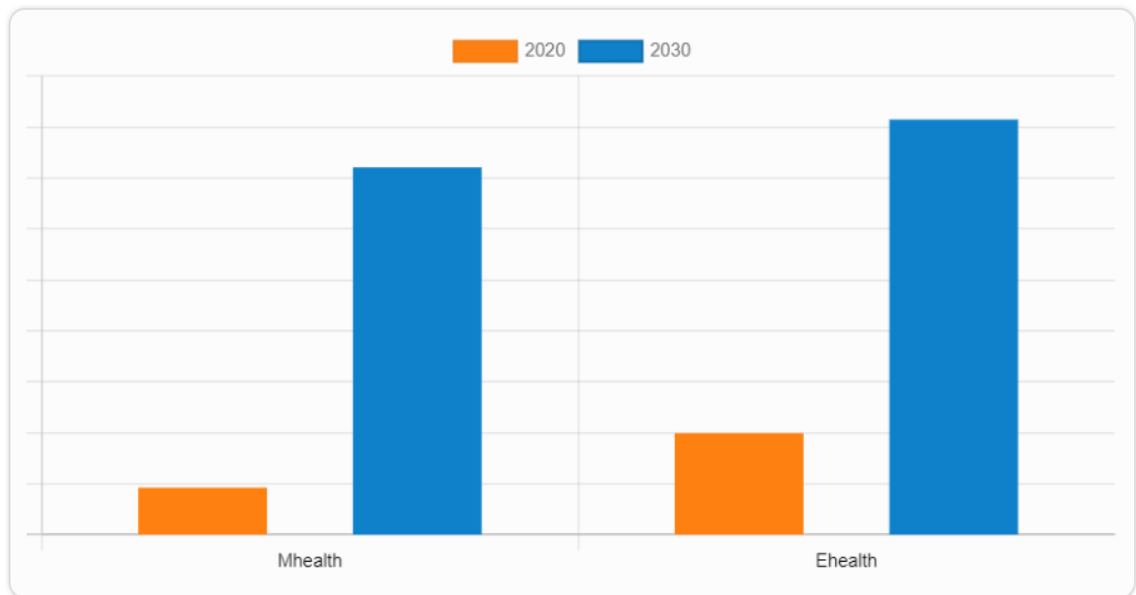
Harmful Rays Detection and Skin cancer prediction App would generally fall under the healthcare and digital health market. Specifically, it would be categorized as a health-related mobile application. The healthcare market is vast and includes various segments, ranging from medical devices and pharmaceuticals to health services and health technology.

The global digital health market size was valued at \$145,884.3 million in 2020, and is projected to reach \$767,718.9 million by 2030, registering a CAGR of 17.9% from 2021 to 2030.

In 2020, the eHealth segment emerged as the dominant force in the market, and it is projected to maintain its leading position throughout the forecast period. This is primarily attributed to the growing prevalence of chronic diseases, a significant rise in the demand for telehealth and telemedicine services, and an increasing number of internet users. These factors collectively contribute to the strong growth and prominence of the eHealth sector in the healthcare industry.

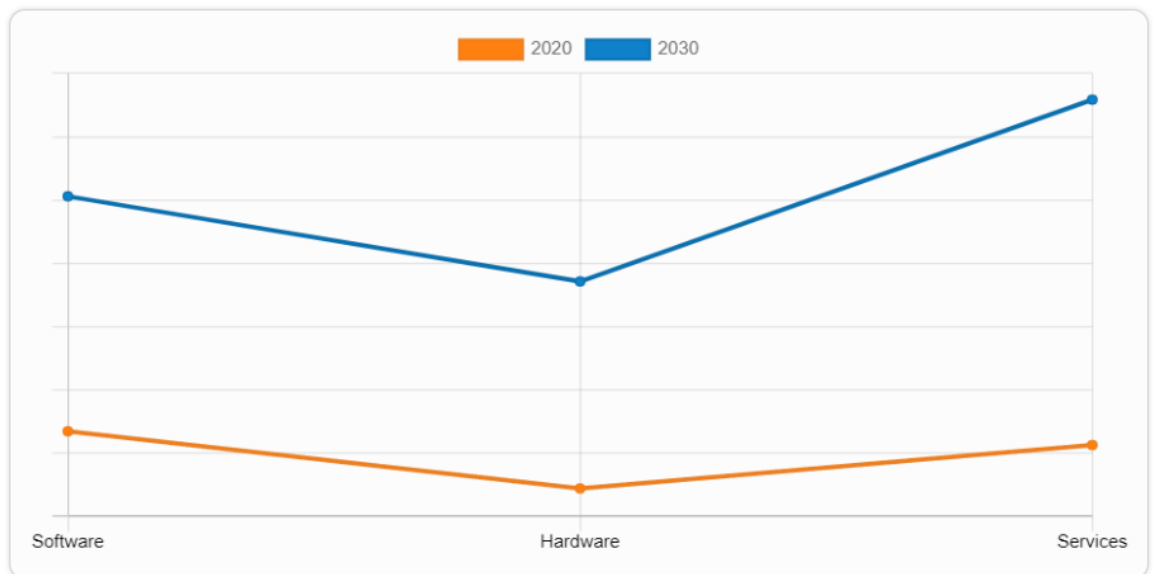
Digital Health Market

By Product & Service



Digital Health Market

By Component



The software segment held a dominant position in the market in 2020, and this trend is anticipated to persist throughout the forecast period. This can be attributed to the continuous advancements in healthcare information technology, a significant increase in the demand for cost reduction in healthcare, and a growing need for organized data and streamlined workflows in the healthcare sector. These factors collectively contribute to the software segment's strong growth and prevalence within the healthcare industry.

From the above the graphs, we can see that Market is increasing linearly.

Now, Let total profit = y

Price of the product = m

Total sale as a function of time = $x(t)$

Total production and maintenance cost = c

Where, Production and maintenance cost include Team hiring cost, office rent, electricity, App maintenance etc.

So, The financial equation for linearly increasing Market,

$$y = m * x(t) - c$$

Let, Price of the product = 1000 Rs.

Total production and maintenance cost = 900 Rs.

So, The financial equation will be,

$$\text{Total profit, } y = 1000 * x(t) - 900$$

- **Conclusion**

The development of a harmful radiation detection and skin cancer predictor app has great potential to improve sun protection and promote early detection of skin cancer. By leveraging machine learning algorithms, such an app can effectively monitor harmful rays from the sun and provide real-time information and alerts to users. Furthermore, the app can contribute to raising awareness of the dangers of harmful rays and educating users on sun safety practices. By providing accurate and real-time information, users can gain a better understanding of the potential risks associated with sun exposure and adopt healthy habits to protect their skin.