GUJARAT TECHNOLOGICAL UNIVERSITY

Chandkheda, Ahmedabad

L. D. College of Engineering

A Report On- ***Smart Fire Alarm System***

Under subject of DESIGN ENGINEERING (semester 3)

(EC Branch)

Submitted by:

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1. INTRODUCTION:

Our team was assigned the work of innovating something under the newly designed syllabus of design engineering.

Design Engineering:

Design Engineering is a general term that covers multiple engineering disciplines including electrical, Mechanical, chemical engineer, aeronautical engineer, Civil, Computer Engineering, Information Technology and structural/ building/ architectural engineers. The uniting concept is a focus on applying the engineering design process, *in which engineers develop new products or processes with a primary emphasis on functional utility.*

Design is a plan of a system, its implementation and utilization for attaining a goal. It is to change undesired situation into desired situation means to find solution for undesired/uncomfortable situation.

Design Engineering is based on globally accepted Design Thinking methodology.

We choose our domain as a Smart Fire Alarm System , because of their benefits & today's need...

2. AEIOU CANVAS:-

AEIOU is an investigative tool to help interpret observations gathered by ethnographic practices in the field. It is a frequently used framework for guiding and structuring observational research. The framework creates taxonomy of observations under the themes of *Activities, Environments, Interactions, Objects and Users* and is commonly used for coding observational data.

Organizational frameworks help researchers and designers to capture key details in observation, and AEIOU is a very easy mnemonic device to remember what to look for and write down. The structure is also a helpful framework for using observational material in design and innovation workshops.

Activity

Activities are goal directed sets of actions—paths towards things people want to accomplish. What are the modes people work in, and the specific activities and processes they go through?

In this part we go at our domain related place and we observe different activities happening at that place.

- ✍We mention elements by which they do such activities.
- ✍We also write such activities which is special or happening occasionally.
- ✍We stick photographs or sketch of our observation**.**

Activities Includes:

- Alerting people and warm people
- Sending SMS to control room

- Turn on emergency alarm
- Calling Rescue team

Environment

Environments include the entire arena where activities take place. What is the character and function of the space overall, of each individual's spaces, and of shared spaces?

In this part we describe-

✍ Where (Activity) is happening?
✍What are circumstances?
Our environment includes:

- Schools
- Homes
- Conference halls
- Offices
- Public transportation

Interaction

Interactions are between a person and someone or something else; they are the building blocks of activities. What is the nature of routine and special interactions between people; between people and objects in their environment, and across distances?

We describe in this part-

✍Who are involved? Why? How?
✍What (users) are holding/ operating/ using… ✍How the contacts are in action?
✍ Action vs. Reaction… The

interactions include:

- Family Member-Fire Brigade
- Between Security Guards
- Students-Guards

Objects

Objects are building blocks of the environment, key elements sometimes put to complex or unintended uses (thus changing their function, meaning and context). What are the objects and devices people have in their environments and how do they relate to their activities? In this part

✍What components are involved?
✍How objects are relating to the activities?

The objects in the project include:

- Fire Extinguisher
- Fire Hydrant
- MCB/ELCB
- Emergency Alarm
- Fuse

Users

Users are the people whose behaviors, preferences, and needs are being observed.

✍Who is there?
✍What are their roles and relationships?

✍What are their values and prejudices?
✍List of identified people involved

The users for the product include:

- Professionals
- Audience
- Passengers
- Students
- Workers
- Spectators
- Employees

3. EMPATHY MAPPING CANVAS

Empathy Map is the canvas where designer has to observe and understand the emotional needs of the user, and on the basis of empathy of user he will think of the solution. A User Empathy Map can help tee up a discussion about the needs a user has. The discussion will be center on what was observed, and what can be inferred about these user groups' beliefs and emotions. An empathy mapping is a tool which helps us summarize our observations and take out unexpected ideas with no restriction & any bound.

Here, User is who is going to use our solution, research or analysis. In this stage, we find the various users which are directly or indirectly related to our project. Users for the product are:

- Professionals
- Audience
- Passengers
- Students
- Workers
- Spectators
- Employees

Stakeholder is a person, group or organization with on interest in a project. In this stage, we find the user who will directly or indirectly related to users. Stakeholders considered for the product are:

- Institutes

- Government offices
- Transport Department

Activities session we describe daily routine of user. Activities are directly or indirectly related to stakeholders. The activities include:

- Alerting People and Warn People
- Sending SMS to control room
- Turn on emergency alarm
- Calling Rescue team

In Story Boarding part we write 4-5 incidents in life of users based on our observation of users.

Happy: Mr. Utsav unfortunately got in a situation when there was a fire caught up in the room next to him but there was no people present in room so due to the smart fire safety alarm he was able to get on site before the fire got much intense.

Happy: Mr. Amit in a room which caught fire due to short circuiting thus due to fire safety alarm the power supply got cut off automatically which saved damages that can be caused if the power supply would not have been cut off.

Sad: Mr. Nayan heard the alarm and when he went on site to see the situation, he saw that there was no fire but the system detected it because of sudden increase in intensity of light.

Sad: Mr. Neel observed that in some public transport vehicles it is not possible to install.

4. MIND MAPPING

A mind map is a diagram used to visually organize information. A mind map is often created around a single concept, drawn as an image in the center of a blank landscape page, to which associated representations of ideas such as images, words and parts of words are added. Major ideas are connected directly to the central concept, and other ideas branch out from those.

Mind maps can be drawn by hand, either as "rough notes" during a lecture, meeting or planning session, for example, or as higher quality pictures when more time is available

5. IDEATION CANVAS

Ideation is the creative process of generating, developing, and communicating new ideas, where an idea is understood as a basic element of thought that can be visual, concrete, or abstract. Ideation comprises all stages of a thought cycle, from innovation, to development, to actualization. As such, it is an essential part of the design process, both in education and practice. He explained how things can be connected to get a better idea.

An ideation canvas is a rough whiteboard/sheet where ideas can be stretched into any limits or dimensions. Ideation session is not aimed at finding solutions to the defined problem. But its aim is to define the best possible problem and stretch out its possible scope. The field is set and the overall agenda is to build the clones of the ideas and pivot them throughout the canvas so as to discover new possibilities.

People

We write down distinct people we can think of or we are interested to solve problems for. We segment them into various groups on the basis of their profession e.g. Teachers, doctors, athletes. Similarly segment them on the basis of their age, income and other characteristics.

We consider the people as:

- Professionals
- Audience
- Passengers
- Students
- Workers
- Spectators
- Employees

Activities

We write down whatever every segment of people do(Activities we had identified at empathy stage (expanding list of user activities)). We make the list, as long as possible- for example teachers: teach, take attendance, prepare class notes, prepare presentations, grade students, evaluate answer sheets and prepare question papers. Similarly; Shoppers, window shop, compare prices, visit stores, return defective goods, claim warranty etc. The activities include:

- Alerting People and Warn People
- Sending SMS to control room
- Turn on emergency alarm
- Calling Rescue team

Situation/Context/Location

Every above mentioned activity can be done in a different situation, location or context. For a teacher – evaluation can be of either subjective or objective papers. At other times it could be of project reports. Evaluation can be either paper/document based or for continuous class behavior which depicts different contexts.

In short, when/why/where- Many activities that user does can vary depending upon changes in situation, location or local condition/context. The environmental conditions are:

- Fire emergency in Halls
- Fire emergency in schools, colleges
- Fire emergency during travelling in public transport

Props/Possible Solution

We note down the objects, technologies or solutions which may be possible outcomes to our idea/challenge. The prop need not be related as it's always randomness that helps in finding new ideas.

In this we write down non-living things or items (components), which

is as follows:

- Emergency Alarm
- Buzzer
- IR sensor
- Fire extinguisher
- Single channel relay module

6. PRODUCT DEVELOPMENT CANVAS

This exercise is meant for giving strategic orientation to the project of each team so that it achieves its true goal as defined by the previous canvas exercises. This exercise is more about developing strategy for the proposed product/solution design, after the team has successfully attempted the ideation process and has incorporated inputs from all stakeholders.

A product development canvas is the ground where in the best possible ideas after the ideation session are pitched and nurtured to develop.

People

We make the segment more focused. We note down the kind of people we have in mind while developing the product and also the people for whom we are resolving the problem. People considered are:

- Professionals
- Audience
- Passengers
- Students
- Workers
- Spectators
- Employees

Purpose

The section should answer the following questions: What is the broad purpose of our product? What problem sector we want to target broadly or specifically. Purpose for the product is:

- Detect Fire
- Alert Occupants
- Manage Risks
- Notify Authorities

Product Experience

Focus in depth on how the customer feels for our product/service concept. We mention every kind of experience we would want our user to feel, enjoy or avail. Also we make a list of all user problems we want to address and how user feels about their problems. Experience obtained for the product is:

- A streamlined emergency response
- Enhanced 24/7 Monitoring

- Efficiency

Product Functions

Product functions deliver the product experience. We convert the product experience into functions for our product/service. What functions our product should perform to meet the customer experience we have just identified in product experience? Mostly the user experience/needs will be our product functions. Functions of the product are:

- Detects Fire automatically
- Building system management
- Activity monitors multiple locations
- Fire department notification

Product features

Features power the product functions. We find product features that will deliver the product functions we have identified. Features of our product are:

- Can be fixed in any area
- Audible alerts
- Flashing lights
- A sensitive carbon monoxide and smoke detector

Key Components

We focus on what the customers feels about a product and find out their problems. Jot down their key experience points, their wish list and the improvements sought. Components included in the product is:

- Call points

- Alarm control panel
- Sounders and flashers
- Smoke detectors
- Initiation devices

Customer Revalidation

We focus on what the customers feels about a product and find out their problems. Jot down their key experience points, their wish list and the improvements sought. Revalidation obtained for the product is:

- Decreases probability of destruction
- Low in cost
- Very estimable
- Fully automatic

Reject/Retain/Redesign

As per the feedback received from users/stakeholders, students' teams need to modify their design and further action plan. In case the whole thing needs to be relooked it has to be iterated with new prospective.

Retain what users like, reject what they don't want & redesign what can be improved to meet the user challenges. Run the Reject/redesign/retain on the functions first and then if required on individual features to find how well they are powering the functions of your product/service. The reasons for rejection are:

- It can also lead to false alarm
- Use of radioactive material is a concern
- Minutes of slower

7. LNM (LEARNING NEEDS MATRIX) CANVAS

A training/competency matrix is a tool used to document and compare the required competencies for a position with the current skill level of the employees performing the roles. It is used in a gap analysis for determining where you have critical training needs and as a tool for managing people development. It can also be used in succession planning as a means of identifying employees who have critical skills needed for promotion.

Tools/Methods/Theories Application Process Involved

We make the segment more focused. We note down the methods to be applied at the time of practical application. The methods used for the successful installation of the product are:

- shouldering device
- relay module working

Software/Simulation/Skill/Mathematical Requirement

The section should mention the skills or the softwares along with the mathematical calculations required to design the product. The softwares used for the designing of the prototype are:

- Multisim

Applicable standards and design specifications/Principles and Experiments

This section mentions the material standards or the design specifications that are setup by the government of the country or a recognized institution. It also mentions the principles on which the product is working

The working principle of the product: Conversion of light or solar energy to electrical energy.

Specifications setup for the design of the products are by:

- Bureau of Indian Standards (BIS)
- Provisions under the article 243W
- Standing Fire Advisory Council (SFAC)

Component materials' strength criteria (explorationvarieties/testing requirements)

In this section, focus is kept on the best suitable materials for the manufacturing of the product and the tests to verify the quality of the product before it is installed or came in use. The best material for the product manufacturing is: Solar grade silicon or polycrystalline silicon solar panels. The testing required to be conducted is:

- False alarming
- Static Analysis
- Detecting proper fire
- Tripping MCB/cutting off power supply

8. ADVANTAGES:

- Alerting people on time or as early as possible
- Can be used in the situations of other emergencies.
- Low maintenance cost

9. DIS-ADVANTAGES:

- it can detect false fire
- sometimes doesn’t cut off power supply