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Conceptual design and prototype of smart calling system research

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KEYWORDS

Calling system, Conceptual design, Prototype, Communication, Design process model, Product design specification, PIC controller.

A B S T R A C T

This study is conducted with the intention of designing, developing and testing a prototype of a 'Smart Calling System' for Mechanical Engineering Department (MED) in Polytechnic Sultan Azlan Shah (PSAS), Behrang Perak. The MED building is consists of 3 floors of staff offices, 4 floors of classrooms and a total of 1388 students. As this involves a large number of students, there is a frequent movement of students flow into the department office to meet their relevant lecturers. The current communication method in MED which is using telephone and PA system is not very effective and has created an unpleasant environment in the staff's office. Therefore the objective of this study is to develop a "Smart Calling System" for the communication purpose in the MED offices. This study was planned based on the Design Process Model (DPM) activity. Results of the developed prototype showed that it provides a better communication tool between the lecturers and students.

Introduction

POLYTECHNIC of Sultan Azlan Shah (PSAS) or previously known as Polytechnic of Tanjung Malim (PTM) is the 15th polytechnic in Malaysia. It is set up by the Ministry of Higher Education. The PSAS's organization structure can be categorized mainly into three groups. There are administrative, academic and supporting department. Among, the academic departments are Mechanical Engineering (MED), Civil Engineering (CED) and Electrical Engineering (EED), Commerce (CD) and General Studies (GS).

The main MED building is consists of 3 floor of staff offices (lecturer rooms), 4 floor of classrooms and a total of 1388 students. In each entrance of staff's office floor, there is a counter or a boundary where the students are not allowed to cross this point (Fig.1). The students need to call from these counter or boundary point to meet their relevant lecturer's. Currently, there is no proper system or mechanism for the students to call the relevant lecturers which they wish to meet. The current method of using telephone or PA system is still not preferable. It creates an unpleasant office environment whenever there is a busy movement of students flow into the MED office. Therefore, this study is conducted with the intention of designing, developing and testing a prototype of a 'Smart Calling System'.

Methodology

Design Process Model (DPM)

The development of 'Smart Calling System' is based on the Total Design Process Model 1 (Fig.2).

Market

This study is focused on communication problems between the students and lecturers in the staff rooms. The communication problem here is referring to the obstacles or problem on the methods or system that is currently used in the MED office. The central idea for this study had been inspired by the facts that, the students and lecturers communication although represent as one of the important needs in daily campus life but there is a no proper system for it. Therefore this proposed "Smart Calling System" is designed to fulfill the student's needs.

Product Design Specification (PDS)

According to Pugh (1991) and Sapuan (1999) there are 32 important criteria of PDS for 'Smart Calling System" design (Fig. 3). Thirteen relevant criteria of PDS are chosen as shown in Table 1.

Development of smart calling system

Conceptual design

In conceptual design stage solution are generated to meet the PDS (Fig. 4). Basically this calling system involves three main component such as MP3 Modulator (to select relevant name from database), Speaker (as the output device) and PIC controller (to control the programming).

Development of conceptual designs

Based on the PDS criteria, a most suited conceptual design is developed (Fig. 5).

Results

Constructed calling system

Based from the conceptual design, a list of design processes undertaken to construct and test the calling system. The design process involves developing programming, hardware and casing for panel (Fig.6 and Fig.7). A test run using the calling system was conducted and proved satisfactory for users (students and staffs).

Concluding remarks

The study focused on designing, developing and testing a prototype of a 'Smart Calling System' for MED in PSAS. The developed calling system enhances the level of communication conformability between the students and lecturers. The system also provided a more pleasant office environment. The results of the fitting trials also proved to satisfy the students and office occupants.

Table.1 Product design specification (PDS) for smart calling system

NO.	CRITERIA	PARAMETER
1	Performance	• It should load the staffs name with not more than 14 peoples (with using one PIC controller) • Built using 'car modulator' concept. • The distance between output and input (calling system) should in the area of frequency within 20m. • The staff's name will store in database (pen drive). • Buttons are used for the inputs for the system. • It should have a device (relays) to control the system operation in the event of power failure. • During operation, the name that has been called out should be repeated within 5 seconds, after the first input. • It should use a portable power source (electrical or batteries source).
2	Product Life Span	• It should be on the operation for within 3 years.
3	Life in Service	• It should withstand an operating period of 8 hours uninterrupted use per day for 3 years.
4	Product Costs	• It should have an end-user cost of RM 350. • The cost of manufacture should be less than RM 100.
5	Quantity	• Initially for MED use (4 units).
6	Maintenance	• To be maintenance free except for the batteries once in 3 months and a recommended service every year. • Batteries changing should be accessible within 15 minutes without using any special tools or equipment. • Spares should be available for a year after the product is replaced with a new model. • No special tools should be required for maintenance.
7.	Size	• Length not to exceed 250mm. • Width not to exceed 250mm. • Height not to exceed 200mm.
8.	Weight	• Weight should not exceed 2 kg.
9.	Material	Car Modulator, components, materials can be obtain from the following sources: • www.lelong.com.my • www.cytron.com.my • State Electronic Trading Com • Nixie Electronic (Malaysia) Sdn. Bhd. • Online Components Sdn. Bhd. • Syarikat Setia Jaya • Nixie Electronic (Malaysia) Sdn. Bhd.
10.	Safety	• The safety accept to the proposed design and it's in the market should be considered.
11.	Installation	• Will consider interface with other product or be assembled into larger product (fixing holes and lugs, access, the volume available for the product, system compatibility, power compatibility and the like).
12.	Documentation	• Product should be supplied with a user manual.
13.	Environment	• All aspects of the products likely environment should be considered and investigated (temperature range, shock loading, dirty or dusty etc)

Fig.1 MED Staff's Office

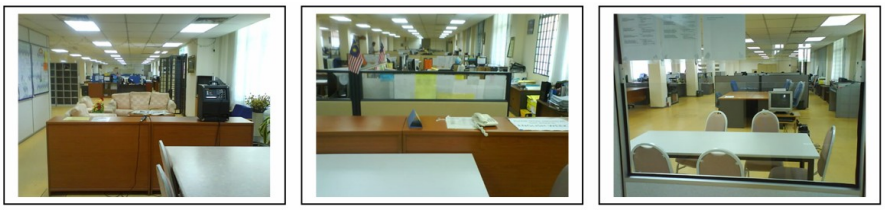


Fig.2 Total Design Process Model

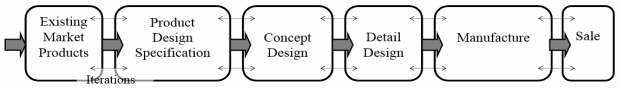


Fig.3 Elements of Product Design Specification (PDS)

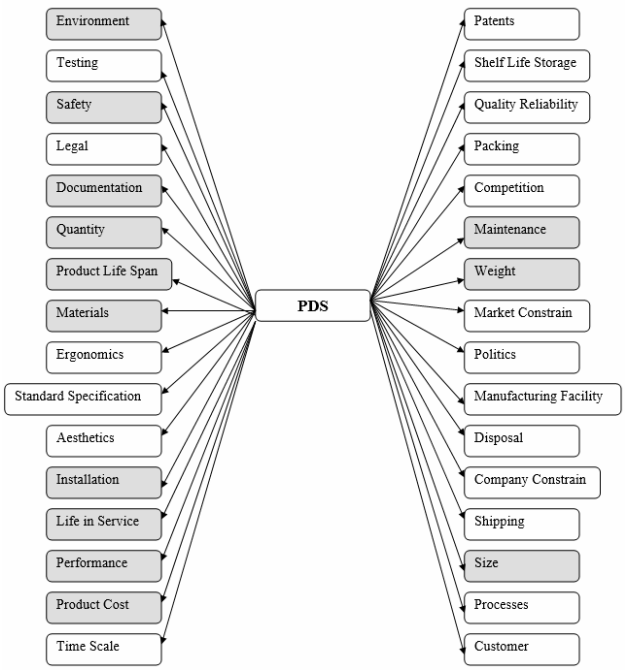


Fig.4 Basic conceptual design for calling system

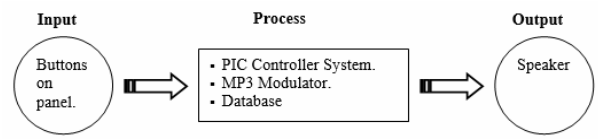
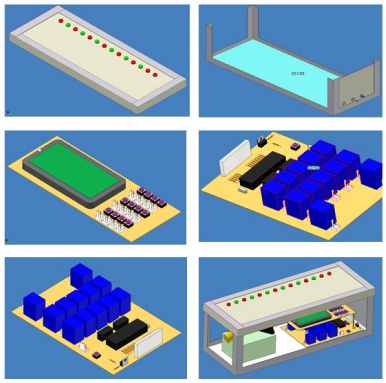


Fig.5 Development of conceptual design for calling system

Fig.6 Development of hardware for calling system

Fig.7 Development of casing for calling system panel



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