Development of Smart Trash Bins (RoboBin) in Tourist Areas

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Abstract: This project is about designing and developing a tool that can create a cleaning service in a certain place. The project built is smart trash and named 'RoboBin'. Trash cans are one of the most important assets for users to ensure that every area is clean. As we know, this trash can is indeed a place where people throw unused materials into it. Without this asset, it is difficult for the community to dispose of this waste, resulting in littering everywhere. In relation to that, other people's views will fall and cause them to lose focus on visiting the area. Tourist places are the focus of many people visiting and the cleanliness aspect needs to be taken care of to provide comfort to all parties whether residents, tourists, owners of tourist areas, and the government. This built project uses a microcontroller that is equipped with several detectors such as ultrasonic sensors, motion sensors, and infrared sensors and is further programmed through the integrated circuit concept to move and stop to give the user time to throw the trash into it and detect the level of trash stored in RoboBin. For this stopping process, it uses a motion sensor that detects the movement of the hand in the area marked on the top of the RoboBin and then it will stop to give time for the user to throw the trash into it. Overall, this project can be used for the convenience of users.

Keywords: RoboBin, Smart Dustbin, Cleanliness In Tourist Areas, Tourist Areas

1. Introduction

The tourism sector is one of the second-largest economic activities in the development of Malaysia. This sector plays a very important role in increasing the national income fund apart from the existing sectors in the development of Malaysia. Our country has a lot of tourist spots due to natural products, historical places, development, beaches, and traditional Malaysian food which causes tourism attraction to increase from year to year by foreign immigrants as well as indigenous people. The propriety of the Malaysian government donating large funds to the tourism sector will further increase the government's funds. Based on the 2022 budget, the high-impact budget announcement

was made by Prime Minister YAB Dato' Sri Ismail Sabri bYaakob to the Ministry of Tourism, Arts, and Culture (MOTAC) in an effort towards contributing to the economic chain related to the tourism sector such as accommodation, transport, food and beverages, travel agencies, art and cultural heritage assets, and event management in this country (Idris, 2021).

IPTEK stands for Science and Technology. Along with the development of the times, science and technology are becoming more sophisticated and support the creation of new technologies (Mulyani & Haliza, 2021). Technology can be built in various aspects. Among the factors that can be applied is the aspect of hygiene. Cleanliness is part of faith (Admin, 2019). The following verse is often used as guidance for the Muslim community in Malaysia. Islam places great emphasis on the aspect of cleanliness because cleanliness is the mainstay of its validity of worship to the creator (Sofi, 2021). Cleanliness is the most important aspect to ensure a clean tourist area. Tourist attractions are more attracted when implementing mobile trash cans in selected tourist areas. Among them are theme parks, recreational areas, and areas with flat surfaces. This is because mobile trash bins or known as Robobins need a flat area to move.

Existing trash cans have a function that all the community knows, which is as a place to dispose of food waste or garbage, but if left alone, the trash can will be full and if ignored, the trash will overflow from the trash can cover until it falls to the ground. This will leave an impact on the environment of the tourism area with an unpleasant smell as well as the community's vision of the overflowing garbage causing negative views from tourists. In this world without borders, information will quickly spread or go viral everywhere. Therefore, tourists who like to give their views on tourism will be expressed regardless of through various mediums such as blogs, YouTube, Facebook, Twitter, and various available applications. When the community surfs the internet is easy to receive the latest information and news through the community that shares the news and so on. In relation to that, the use of this element is able to influence the mentality of the community as well as foreign touristsin the application of hygiene aspects in the surrounding area (Borneo Online, 2018).

1.1 Trash Can

A trash can is a container for the temporary disposal of trash that is usually made of plastic, metal,or iron. Garbage is defined by humans as something that has been used (Hafiz, 2015). Trash cans can be seen everywhere. The practice of using rubbish bins needs to be made a culture among the community to improve the quality of the environment (Ipoh City Council Official Portal, 2022). All trash must be thrown into the trash can to ensure cleanliness. According to Hafiz 2015, there are two types of garbage that can be categorized organic garbage and inorganic garbage. Organic waste is simple waste decay such as food waste, vegetables, dry leaves, etc. while inorganic waste is waste that does not rot such as plastic food packaging, paper, plastic toys, bottles, and drinking glasses, wood, and so on. In this study, the trash bin has been intelligently innovated by using sensors and alarms that are controlled by using a microcontroller.

1.2 Tourism Area

The concept of the tourist area is used to name a region that has certain special characteristics that are attractive to tourists. This may be due to the area marked by its natural beauty, history or cultural performances to welcome several possibilities (Vocabulario, 2022). In this study, the tourism area is the scope of this study. Various tourist areas can be linked such as recreation parks, stadiums, museums, zoos, beaches, and so on. This study, this project was carried out in a tourism area that has a flat earth surface compared to an uneven one due to the functionality of the project.

2. Methodology

The developer selected the Prototype model as a guide. The researcher found that the Prototype model is one of the most suitable methods because they are more concise, clear and easy to use in the development of smart trash bins (RoboBin) in tourist areas.
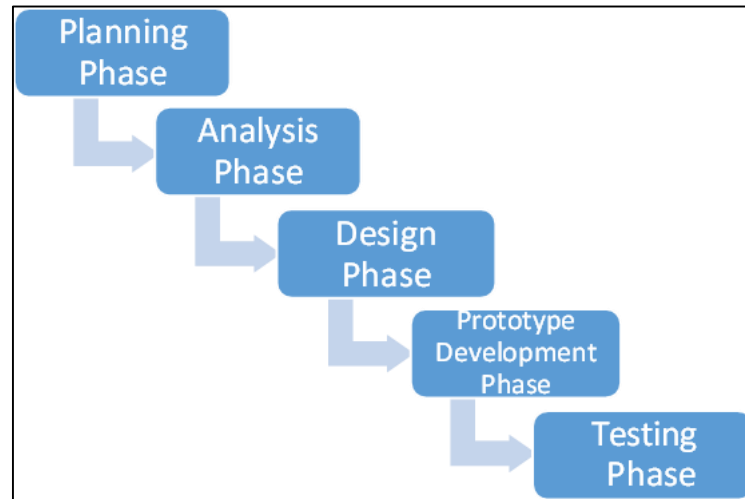

Figure 1: Prototype design model

Figure 1, The prototype design model is one of the software development life cycle models in which a prototype is built with minimal requirements. This prototype is then tested and modified based on the feedback received from the client until a final prototype with desired functionalities gets created. This final prototype also acts as a base for the final product (Rana & K, 2020). The researcher has designed a model that has 5 phases, namely the planning phase, the analysis phase, the design phase, the prototype development phase, and the testing phase. This model is used by researchers as a guide to building build a prototype.

In the initial phase, the planning phase is a phase for the researcher to plan the production of a direction to ensure that the construction of the prototype runs smoothly. A Gantt chart is produced to guide the researcher to refer based on the things/activities that need to be done in a predetermined period. Planning in the development of this RoboBin requires a careful study in the selection of suitable items such as sensors, wiring and soldering items, cutting items, items for the tidying phase, and so on. After finishing listing as indicated, then the researcher will frame the coding through the flow chart that has been built as a guide. The planning done by the researcher is more of a construction in the tourism area where it is the scope of the project to improve the quality of cleanliness in the selected tourism area.

Every item list-built guide and coding design needs to be analyzed. This analysis phase is a phase to study decision-making for each preparation that has been done. In relation to that, this time is still used in each of the other phases because when doing prototype development work, there is still a probability of problems arising that make the researcher think to ensure that the problem can be solved. When setting up a project as well, the researcher indirectly comes up with the idea of adding a new function or improvement to the prototype to ensure that the prototype produced gives a more positive impact.

Prototype development should be completed with the design phase. Design is a phase where the researcher thinks about the appropriate form before designing a good product. Every corner and part of the design needs to be emphasized because it gives its own function, and the impact must give a positive meaning to the prototype and the user. The researcher has built a design starting with the idea of using a pencil and drawing on paper. After analyzing the design, the researcher started building the design using Sketchup Pro software. Each part can be taken through 3D Warehouse and then combined with all the materials that have been downloaded and uploaded in the software to build the design that the researcher has made. For the wiring design, the researcher uses Fritzing software because this application produces complete and easy-to-understand diagrams for the researcher to make the wiring for the actual construction later. The coding construction is also used in the Arduino IDE software, as the researcher uses an Arduino Uno as the microphone control in this prototype. The construction of this coding takes a long time to ensure that each coding that is built works as planned by the researcher.

The prototype development phase is the phase where the researcher begins the work behind the development of the prototype. Data collected is based on the design phase and the analysis phase as a guide to developing the prototype. These works require adequate equipment and materials to ensure that the prototype can be produced well. In this phase, careful detailing is required to avoid wasting time, cost, and energy. In this last phase, the researcher will test the prototype that has been done. Every sensor, indicator, and motor need to be tested to ensure that the functionality is the same as the researcher wants. Each test must be recorded for the researcher to analyze. The collected data will be studied and compared to allow researchers to conclude whether the sensors and functionality used are accurate or need to be changed for improvement. Testing is also done to assess whether the goods used are suitable or damaged. Testing also needs to be done based on the scope of work.

3. Results and Discussion

Figure 2 shows the RoboBin prototype produced by the researcher in the tourist area.

Figure 2: Smart Dustbin (RoboBin)

Figure 3 shows the instruction book for using RoboBin. Before users use this product, they should read all the instructions before starting the garbage collection process and its movement.

Figure 3: RoboBin handbook

Figure 4 shows a video of the introduction of RoboBin produced by the researcher as a guide andlearning in the use of RoboBin.
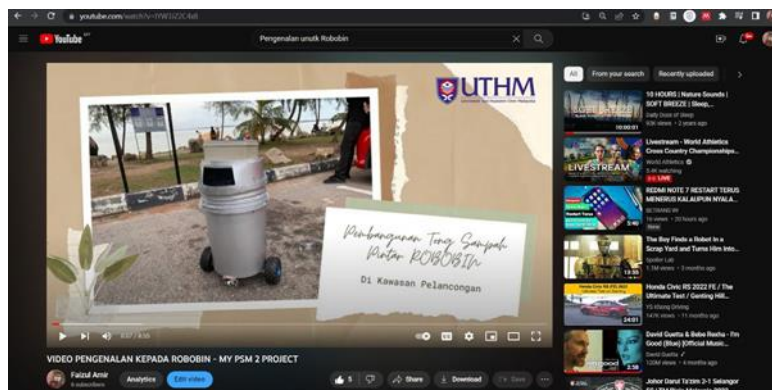

Figure 4: Introduction to RoboBin Video

The development of the RoboBin smart trash can is implemented with various sensors to facilitate the user's work. This prototype uses three (3) parts, namely, the Ultrasonic sensor, PIR sensor (Motion Sensor, IR sensor (Infrared sensor), and Motor. All the use of parts is complementary to the overall functionality of RoboBin. Figure 5 shows the block diagram for the functional RoboBin.
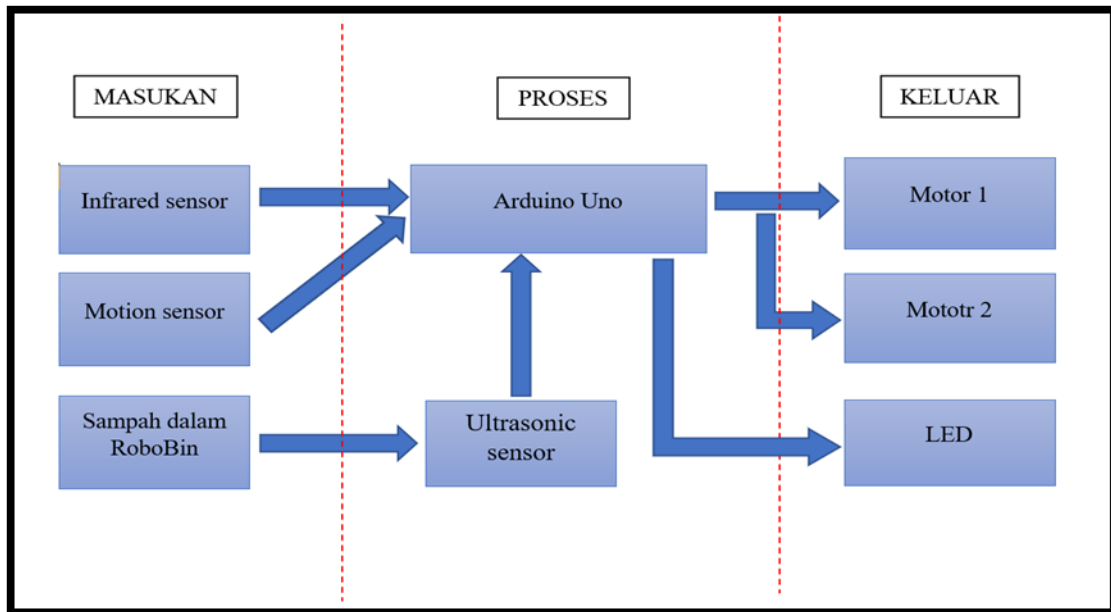
Figure 5: Block diagram RoboBin

Ultrasonic sensors are electronic sensors used by researchers to detect the level of garbage in the RoboBin. This ultrasonic sensor is connected to an LCD display that responds to display the value of the percentage of garbage contained in the RoboBin. This will make it easier for users to identify whether the RoboBin has reached full trash or not. If the garbage contained has reached the maximum,then the bin will stop moving the garbage collection process and will even go to the cleaning center to empty the garbage. The pilot lamp is used in this project as an indicator to guide the user on whether the RoboBin is in the process of collecting garbage or the process of cleaning accumulated garbage.

In relation to that, PIR sensor, or known as the Motion sensor is used by the researcher to be given the function of detecting the movement of the user's ladder towards RoboBin. When the PIR sensor detects the movement of the ladder, it will stop moving. A few seconds will be given to ensure that users can throw the trash into the trash. Throughout the research done on this part, the researcher thinks that using the PIR sensor is unsuitable due to its very high sensitivity, which causes it to detect handmovements or other movements. This will cause the movement of the RoboBin to always stop when placed in an open area. For this reason, the researcher recommends that the use of an Ultrasonic sensor orIR sensor is the best option to get the function desired by the researcher.

In addition, the IR sensor is an Infrared sensor used by the researcher to detect the black path on the road surface. This IR sensor is connected to the RoboBin movement process, and it is also connected to the 2V 8Kg DC Motor. The researcher used a black path with black tape for this prototype through the designated path only.

This DC motor has good specifications where it has strong force and pressure against the objection that can be carried by the motor with a limit of 8kg. It is very suitable because the garbageto be carried has a different weight. Two (2) motors are used for this prototype to turn left or right.

4.   Conclusion

Overall, this smart trash bin (RoboBin) successfully achieved the objectives of the study that had been set. Suggestions for improvement are also discussed to give ideas to product development in the future so that it can better solve more problems with the cleanliness of the environment and also the weaknesses that exist in this prototype.

Acknowledgment

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