AwareME: Public Awareness through Game-Based Learning

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***Abstract* - It is widely recognized that a nation with minimum problems relating to areas such as health, environment, infrastructure, and technology is a developed country [1]. However, the developing/ lower-middle income countries need many improvements in the above-mentioned areas, as they are still lacking in those areas [1]. Apart from the risk associated with these problems, the main challenge faced by developing countries is, making the public aware of these problems. In this paper, we are proposing a mobile game-based learning platform: "AwareME" which focuses on following problems: (1) health awareness (dengue fever), (2) environmental awareness (garbage disposal), (3) cyber security awareness (social media) and (4) safety awareness (road safety). The "AwareME" platform includes quizzes, 2D/3D puzzle games, and 3D action games with activities to improve the cognitive skills and awareness of the public. We have provided the results of an initial performance evaluation of "AwareME" platform.**

Keywords— Game Based Learning, Health Awareness, Cyber Security Awareness, Environmental Awareness and Road Safety Awareness.

I. INTRODUCTION

In modern world, developed countries have minimum problems related to areas such as health, environment, infrastructure, and technology. However, developing countries face many problems in those areas, such as, diseases, natural disasters, deathly accidents etc. According to the United Nations, some of the main problems faced by citizens of developing countries/ lower-middle income countries are related to health, environment, safety, and cyber security. Apart from the risk associated with these problems, the main challenge is making the public aware of these problems. Even though there are public awareness programs on these problems, they are not very effective, as they are not attractive, and the public is too busy to attend the programs.

However, as people are more interested and addicted to mobile devices, developing an interactive awareness platform for mobile devices, is a productive way to improve the awareness. Moreover, instead of traditional approaches, adopting to new concepts such as game-based learning will be more effective to improve the awareness [2]. Therefore, improving public awareness through game-based learning with the use of mobile devices, will be an effective solution.

As shown in Figure 1, we have implemented a game-based learning platform: "AwareME" to improve the public awareness on four main problems in the developing countries: (1) health awareness (dengue fever), (2) environmental awareness (garbage disposal), (3) cyber security awareness (social media) and (4) safety awareness (road safety).

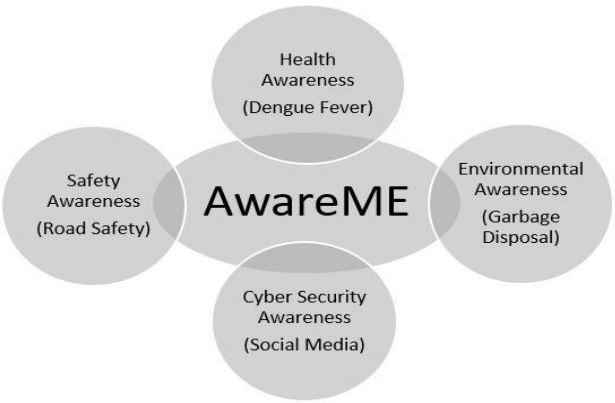

Fig. 1: AwareME Gaming Platform

To improve public awareness in each category, different skills need to be improved. Cognitive skills such as memory retention and analytical skills can be improved by repeated playing of digital games [3]. Therefore, cognitive skills which are required for each awareness category are identified at the initial stage and games are designed accordingly.

The "AwareME" platform consists of: (1) a health awareness game to improve the thinking, recalling and decision making abilities, (2) an environmental awareness

game to improve thinking, recalling and decision making abilities, (3) a cyber security awareness game to improve decision-making ability and (4) a safety awareness game to improve logical thinking, recalling and decision making abilities was proposed. The games consist of quizzes, puzzles, and action games where 2D, 3D and VR technologies are used for effectiveness. We have conducted an initial review of the performance of the "AwareME" platform, and the results show that with the help of the "AwareME" platform, the expected skills of the people are improved, and through that, public awareness in all the four areas are improved.

The rest of the paper is organized as follows. Section II presents the related work. Section III introduces the four modules of "AwareME". In section IV, the result and discussions are presented. Final Remarks and References are mentioned in Section V and VI, respectively.

II. Related work

Even though the game-based learning is a well-recognized approach, the research work in using game-based learning to improve awareness are very limited. The work on [4] have developed the 'Sustainability Game' to understand the experiences and conceptualizations of undergraduate students on sustainability issues in public spaces. The authors of [5] have conducted their research to develop a role-playing game-based learning platform to improve environmental awareness. The work on [6] have developed a mobile game to improve the public awareness on flood and their results show a significant improvement on players awareness. The authors of [7] presents a Serious Game about dengue fever prevention that uses collaborative and competitive interactions approaches. The research [8] proposes a web application that allows kids and teenagers to experience the typical dynamics of information spread through a realistic simulation. Their results show that their approach is stimulating and supports teachers in helping kids discover and recognize potential privacy risks in social network activities. The authors of [9] present a video game with a storyline that revolves around a girl named Julie who is tasked by Heidegger Industries to clean up a community full of waste using her special gun that can teleport trash to waste processing facilities to be recycled or disposed of properly. The results show that the game promoted awareness to the environment while being fun and engaging. The study on [10] evaluated the effectiveness of a video that has been released by a popular children's entertainment group to help tackle Britain's poor record on children's road safety. A robust pattern of null findings indicated that the video, when used in this casual fashion, had no educational impact on either parents or children.

Most of these projects have focused on only on one awareness category. Also, the available applications are not interactive, they have only mentioned the instruction, and people must read and understand. But in "AwareME", users get the opportunity to actively participate in the activities and have a real time experience about four awareness categories. Unlike the other available applications, "AwareME" considers four awareness areas and targets kids and adults at different levels.

III. Methodology

The game "AwareME" is designed to educate the public on four major issues related to health awareness, environmental awareness, cyber security awareness and safety awareness. We have specifically considered awareness on dengue fever, insecurity on social media, improper garbage disposal, and carelessness about road accidents. The games are created using 2D and 3D technology, because then the games are attractive to users. Also, the "AwareME" platform is an Android mobile application which is created using the Unity game engine.

To improve public awareness in each category, different skills need to be improved. The skills include thinking ability, decision making, reacting speed, and recalling ability. Therefore, at the initial stage, cognitive skills which are required for each awareness category were identified. Next the games were designed accordingly to improve the identified skills. For each awareness category, two games were developed, targeting to improve two necessary skills.

We collected opinions and suggestions from the people who work in divisional secretariat offices, hospitals, and schools about suitable games for different awareness categories. The information was collected through a Google form which were filled by kids and adults in different ages and professions. All the gathered data, specially opinions and suggestions on awareness methods, were considered when developing the requirements and design of our AwareME game.

The proposed AwareME was developed by following the iterative methodology of software development life cycle. An iterative life cycle model does not need to start with a full specification of requirements. Instead, development begins by specifying and implementing just one stage of the game, which can then be reviewed, to identify further requirements. The process is repeated, producing a new version of the game for each cycle of the model.

A. Improving awareness on dengue fever

The first module of "AwareME" platform focuses on health awareness, specifically on dengue threat. We have identified three main stages for dengue awareness: (1) awareness on preventing dengue fever, (2) awareness on responding when suffering from dengue fever and (3) awareness on speedy recovering from dengue fever [11]. We have developed a puzzle game to improve thinking ability and recalling ability and, a 3D Action game to improve the decision-making ability for above mentioned awareness stages.

The puzzle game has five levels and levels are categorized into three parts as thinking, memorizing, and summarizing. As shown in Figure 2, a standard puzzle is given to think and solve at a given time, targeting to improve the thinking ability. After the successful completion of puzzles, a tag with specific actions required for previously mentioned dengue awareness stages is shown, to read and memorize. Finally, for the summarizing, players are required to identify the correct summary, which describes the specific actions required for corresponding dengue awareness stage.

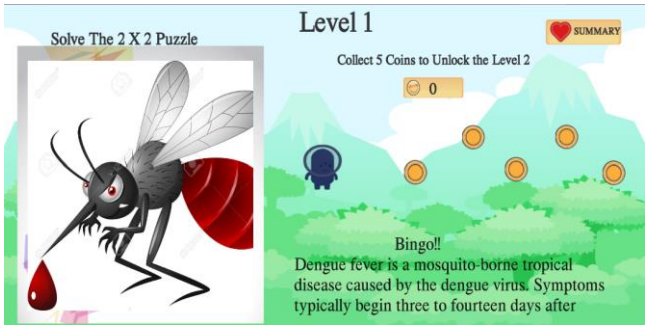

Fig. 2: Puzzle game to improve awareness on dengue fever

The 3D action game has three levels and as shown in Figure 3, it uses maze runner decision making concept. Players must take necessary decision-making actions to get out from the maze. Decisions are based on dengue prevention, response, and recovery.

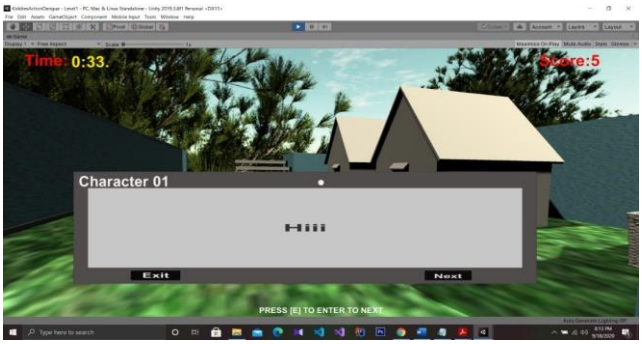

Fig. 3: 3D Action game to improve awareness on dengue fever

B. *Improving awareness on Social Media*

The second module of "AwareME" platform focuses on cyber security awareness, specifically on social media. Awareness on user privacy is one of the main factors required for social media [12]. The awareness on user privacy, highly depends on awareness on strong passwords and information sharing practices [13].

As shown in Figure 4 and 5 we have developed a quiz and a puzzle to improve decision-making ability when creating a strong password and sharing information.

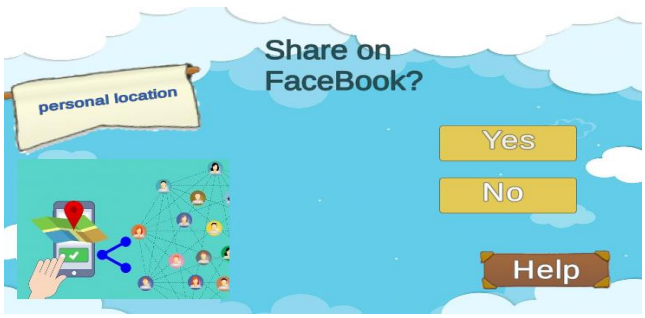

Fig. 4: Quiz to improve awareness on social media

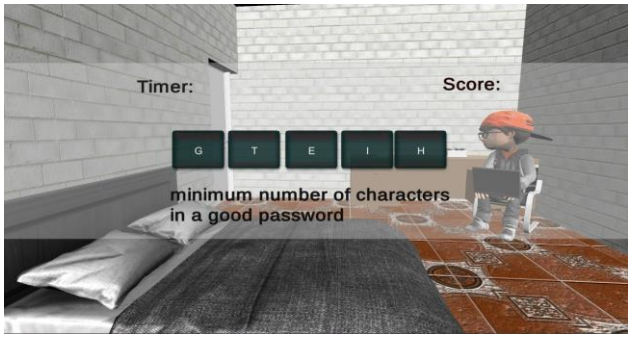

Fig. 5: Puzzle to improve awareness on social media

C. *Improving awareness on Garbage disposal*

The third module of "AwareME" platform focuses on environmental awareness, specifically on garbage disposal. We have identified three main aspects of garbage disposal which require public awareness: (1) methods of decomposition, (2) methods of disposal and (3) pollution caused by garbage. We have developed a quiz to improve thinking ability and recalling ability and, a 3D Action game to improve the decision-making ability for above aspects.

As shown in Figure 6, the quiz includes three levels, where players are given quizzes on methods of decomposition, methods of disposal and pollution caused by garbage. As shown in Figure 7, in the 3D action game, the player is given a set of materials and the opportunity to dispose them in a proper way.

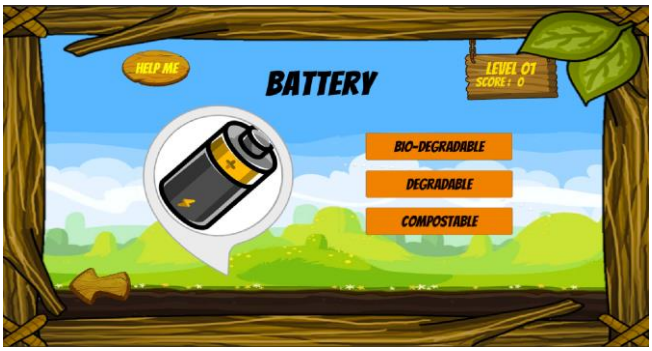

Fig.6: quiz game to improve awareness on garbage decomposition (For children)

Fig. 7: 3D Action game to improve awareness on garbage disposal (For Adults)

D. Improving awareness on Road Safety

The fourth module of "AwareME" platform focuses on safety awareness, specifically on road safety. We have identified three main areas that require public awareness: (1) traffic rules and regulations, (2) prevention of accidents and (3) pedestrian safety measures. We have developed a quiz to improve thinking ability and recalling ability targeting above mentioned areas. Also, a 3D Action game to improve the decision-making ability and reacting ability targeting the same areas. As shown in Figure 8 and Figure 9, we have developed two separate games both pedestrians and motorists.

Fig. 8: Quiz to improve awareness on road safety (For motorists)

Fig. 9: 3D Action game to improve awareness on road safety (For pedestrians)

IV. RESULTS AND DISCUSSION

The main expected outcome of this research is to enhance the abilities such as decision making, logical thinking, reacting speed and recalling ability which helps the public to avoid problems caused by the areas in health, environment, cyber security and road safety.

In the initial stage of performance evaluation, the "AwareME" Android mobile game was given to a set of randomly selected people including kids and adults, and they were asked to play the same game twice. We recorded their performances for attempt number 1 and attempt 2 and then compared their improvements from attempt number 1 to attempt number 2.

TABLE I: Results of the performance of the participants in health awareness

Attempt	Marks (%)					
	U1	U2	U3	U4	U5	U6
1	70	46	74	59	30	40
2	75	58	79	62	38	73

TABLE II: Results of the performance of the participants in cyber security awareness

Attempt	Marks (%)					
	U1	U2	U3	U4	U5	U6
1	59	50	70	59	60	46
2	78	66	77	76	74	65

TABLE III: Results of the performance of the participants in Environmental awareness

Attempt	Marks (%)					
	U1	U2	U3	U4	U5	U6
1	60	56	45	62	68	56
2	78	70	67	78	82	73

TABLE IV: Results of the performance of the participants in Safety awareness (Driver Game)

Attempt	Marks (%)					
	U1	U2	U3	U4	U5	U6
1	54	46	75	65	52	76
2	60	60	85	73	67	90

The test results shown in Table I to Table IV, show an improvement in the scores of the players, when they re-try the activities. There is an improvement of the scores through attempt 1 to attempt 2.

Fig.10: Player 1 awareness improvement on four categories

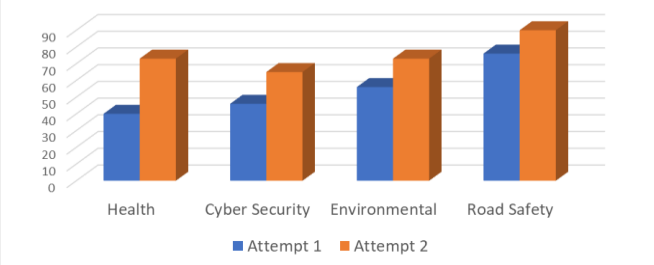

Fig.11: Player 6 awareness improvement on four categories

Figure 10 and 11 show summarizations of how Player 1 and Player 6 have improved their awareness levels through attempt 1 to attempt 2. Thus, it shows that AwareME is useful in improving the awareness among public

V. FINAL REMARKS

We have implemented a game-based learning platform: "AwareME" to improve the public awareness on four main problems in the developing countries: (1) health awareness (dengue fever), (2) environmental awareness (garbage disposal), (3) cyber security awareness (social media) and (4) safety awareness (road safety). The gaming platform consists of puzzles, quizzes and action games that are required to improve cognitive skills such as thinking ability, reacting speed, decision-making ability recalling ability. We have used game-based learning and interactive game designing techniques in our research to develop the "AwareME" platform as a mobile game.

We have conducted the initial evaluations to check the performance of the four types of modules and the results show that, with the help of the provided solution, the expected skills of the people are improved, and through that awareness among public is improved.

As future work, we are planning to enhance our games with more effective techniques to attract players. Also, we are planning evaluate the performances of the games comprehensively using a large set of players.

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