Framework For Preventing Procrastination And Increasing Productivity

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***Abstract*—Productivity is an assessment of the efficiency of a person, mostly an employee in a specific period of time. One of the major blockers for a productive session is procrastination. Procrastination is the action of delaying or postponing the work. As a result, the overall productivity of the project or the task will be affected. There is lots of research done on how to increase productivity. In real-time, there are certain professional tools used in practice to monitor productivity. For example, Sprints are in some of the software industries for splitting the work into modules and focusing on each of them, one at a time. However, it is not as flexible as one would like and perhaps a bit too complex as far as the general population is concerned. On the other hand, simple tools using Pomodoro technique, Gamification, etc., are used in some places but one simple technique may not be sufficient. Therefore, we propose a simple generic tool that combines Pomodoro technique, Gamification and Leaderboard to avoid or stop procrastinating of an employee. The Pomodoro Timer technique helps in breaking up a large task into sessions, with each session being followed by a break. ProScore tries to influence users to work productively using the points system, "Productivity Score" and by showing their peers, i.e. other users' productive session details. Next, leaving the task midway of a session penalizes the user by reducing their points, which is called Gamification. Then, Leaderboard is used based on the Points that the employee has scored. This provides users an incentive to top the leaderboard and hence be more productive while doing so. Finally, we also keep track of all the productive sessions so that a user can revisit how they have performed over a course of time.**

Keywords—ProScore, Productivity, Pomodoro Technique, Procrastination, Peer-pressure, Points, Incentivization, Time estimation.

I. INTRODUCTION

For many people, procrastination is a strong and mysterious force that keeps them from completing the most urgent and important tasks in their lives with the same strength as when you try to bring like poles of a magnet together.. It is also a potentially dangerous factor that leads victims to struggle, perform poorly at work, put off medical treatment, or delay retirement savings. This will contribute to lowered morale and cause us to struggle to meet our goals. We will become demotivated and dissatisfied with our jobs if we procrastinate for a longer period, that can also cause a lot of stress and even loss of a job, in serious situations.

The Pomodoro Approach is one of the easiest ways of resolving such depression. The technique is named after the use of a traditional tomato-shaped kitchen timer ('pomodoro' in Italian, see Figure 1). The Pomodoro Strategy is a method of time management that allows individuals to work for, rather than against, the time they have. You split the workday into 25-minute chunks followed by five-minute breaks using this process. Such cycles are known as pomodoros. You take a longer break of about 15 to 20 minutes after only four pomodoros. The principle behind the strategy is that a sense of urgency is instilled by the timer. You know you only have 25 minutes to make as much progress on a job as possible, rather than pretending like you have infinite time in the workday to get things done and then ultimately squander those valuable work hours on distractions. In addition, the forced breaks tend to cure the frazzled, burnt-out feeling that most of us endure at the end of the day [20]. Without even considering it, it's difficult to waste hours in front of your mobile, when the ticking timer reminds you to get up and take a bit of a break.

In our framework, the traditional Pomodoro approach is little modified (custom timer instead of a traditional 25-minute timer) and has incorporated few other proven variables such as peer influence, gamification and incentivization, in addition to the methodology.

Fig. 1. A tomato-shaped timer

Peer pressure is when someone is motivated by their peers to do something good or improve progress. Peers who are devoted to doing well in their work, for example, will influence others to be more goal-oriented. Similarly, sporty, loyal or welcoming peers influence others to do the same.

The practice of building rewards into an arrangement or scheme to empower the actors inside it is incentivization. It is based on the premise that people inside such a system can not only do better when they are manipulated, but also when incentives are offered.

Thus, the combination of all the above methods (Pomodoro timer, Peer-influence, incentivization and gamification) is the proposal of a framework called ProScore.

II. LITERATURE SURVEY

Research says that procrastination can be improved by using smart phone app based approach rather than using a traditional approach [22]. In this technical world everyone is accustomed to use a smartphone, this makes it easier to disseminate the application. Promising results for the

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evidence of mental health apps come from a systematic review of several studies producing evidence for smartphone-based mental health interventions , showing that apps can be effective in the reduction of symptoms of anxiety, depression, stress and substance use. ProScore being a simple mobile based application can play a major role in reducing procrastination even in small fields.

Agile Sprints is one technique whose idea is closely followed in ProScore. Using Agile project management methodologies, projects are broken down into sprints or iterations. These are short, repeatable phases, typically one to four weeks in length [24]. Our technique deals with much more granular tasks which are to be completed in minutes of time. i.e. the tasks are grained further into much smaller chunks. Also, ProScore is not constrained only to Agile, but can also be implemented in any kind of tasks whose work-flow and the outcome are well known in prior. Clearly, ProScore being a Simple Tool that's aimed at a general population and it is not aiming to be a competitor to professional tools like scrum, sprints which are complex in nature [24, 25].

III. The ProScore framework

ProScore is a mobile application framework meant to increase the productivity of an individual which is lagging due to procrastination. The Pomodoro Timer technique helps overcome this by allocating a session of 25-minutes followed by a 5-minute break. This alone won't help. We also need some kind of peer influence that forces us to be productive. ProScore tries to influence users to work productively by showing their peers aka other users' productive session details. When we see that others are doing something productive, we feel the compulsion to do productive work ourselves. Furthermore, ProScore incentivizes Productivity through the Point System. The name of the application is derived from "Productivity Score". This ensures that the more productive you are, the more points you will earn. Leaving the app midway during a session penalizes the user by reducing their points. This leads us to the next productivity enhancing technique - Gamification. We use a Leaderboard based on the Points they have scored. This provides users an incentive to top the leaderboard and hence be more productive while doing so. Finally, we also keep track of all the productive sessions so a user can revisit how they have performed over a course of time.

A. The Pomodoro Technique

By good time control, the Pomodoro Technique aims to promote focus, consciousness, and independence of mind [1]. A pomodoro is 25 minutes of uninterrupted, concentrated work on one task followed by 5 minutes of rest and recovery. Based on scientific evidence, the inventor says, "20 to 45-minute time intervals can maximize our attention and mental activity, if followed by a short break" [5, 20]. The 5-minute break is designed to help team members build and sustain an optimum focus curve when working on project tasks. A longer pause of 15 minutes is suggested for every four consecutive pomodoros to maximise the influence of this result. An individual's efficiency can be improved with this method. Increased optimism leads to increased efficiency, and the approach has also proven useful in assisting in the handling of complex scenarios. These advantages can be obtained by using the Pomodoro Technique's two interconnected features: time-boxing and length estimates.

Pomodoro as Time-box : Time-boxing is one of the key inspirations for the Pomodoro Technique [5]. When a set of events is delegated to a certain time interval, time-boxing means that the delivery deadline for such activities can never change. Unfinished operations may be reassigned to the next time cycle if desired.

Pomodoro as Unit of Effort : The Pomodoro Technique, when used as an effort estimation method, will help optimise an effort estimation mechanism by requiring constant reflection of team activities [5]. The Pomodoro Technique was originally developed as a personal time control method for individual jobs. However, the technique's inventor and proponents have built and perfected it over time in the form of coordination. Several XP teams use the methodology as a team time management tool, according to [6]. They say that using the Pomodoro Technique to help teams find their "normal" rhythm in everyday work is both stress-free and effective.

Pomodoro Technique in ProScore

Each job will have its own work time in the ProScore application, and the entire slot will be split into a number of pomodoros, each of which will specify a timeslot and unit of work. We use a timer to keep track of the pomodoros, and for each one, there is a mandatory break period. Rewards will be granted in the form of points based on the completion of pomodoros. For each good completion, points will be awarded (table 3.2.1), and in the event of any deviation, the points will be deducted by 5. As a result, if the user fails, the likelihood of falling through bad points is very high, motivating the user to be more aware of points and, as a result, increasing productivity[3]. The user's task time will be taken as input, and each task time will be split into pomodoros, with the following calculation:

$$N = t / 120 \quad (1)$$

$$T = t \,\%\, 120 \quad (2)$$

Where, 'N' represents the number of cycles, 'T' represents the total time and 't' represents the input time.

The explanation for the division and modulo by 120 is that the traditional pomodoro technique uses a 25-minute pomodoro followed by a 5-minute pause, for a total of four pomodoros in one cycle and a 15-minute break will be provided at the end of each loop . Since not every task in our programme is supposed to take 120 minutes, we measure the number of cycles and the time from the input time as in (1) and (2), and further pomodoro estimates are mentioned in Table I.

TABLE I. Pomodoro time estimation)

Time (T)	Pomodoro(s)	Pomodoro Time (t)	Break Time (b)
0 < T <= 30	1	T	Nil
30 < T<= 60	2	T/2 - 5	5
60 < T<= 90	3	T/3 – 5	5
90<T<= 120	4	T/4 – 5	5

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B. Gamification

Gamification is the practice of adding affordances to programmes in order to provide more engaging opportunities and improve behavioral outcomes [7]. The core concept behind gamification is to use game design features in non-game contexts to exploit the motivational power of video games [2].According to some gamification research, the majority of studies show that it has beneficial impacts on people. Over the past decade, gamification has evolved into a new market strategy that employs game mechanics and design elements to track, control, and reward consumer behavior. It applies the nature of game characteristics such as goals, rules, playfulness, fun features, reviews, incentive, and promotions to a real-world business issue. When these game mechanics are used in a non-gaming sense, they can increase engagement [4].

a) Game elements in ProScore

We use the gamification components like user avatar, leaderboard, points, badges, process bar etc.

Points: The reward scheme includes points. Users are rewarded with points for acts that we believe are essential to the platform/application. Points are real-time reviews provided to users for their activities in order to help them appreciate the connection between effort and rewards. As a result, in our case, points are awarded for completing assigned tasks.

• Leaderboards: These are similar to game leaderboards in that they enable users to compare their rank to that of other members of the group. The fundamental premise behind this aspect is that people want to be the best, to be at the top of the leaderboard.

• Badges: A study [9] states that badges are awarded to users in order to provide them with something to brag about. It works on the same basis as sporting trophies or awards. Badges can be earned permanently or just for a temporary time.

• Avatar: The way in which users chose to connect with other members of the network. In the game, this is a graphical representation of themselves. An avatar may be an icon, picture or a photo of the users themselves.

• Process bar: Process bar shows the completion and progression of a user in a game. In our application, the timer is to be regarded as a process bar as the time worked and the time left can be inferred easily from it.

b) Gamification in ProScore

ProScore uses all the game elements mentioned in 3.1 as follows. Initially they are entitled to create a profile. Once the profile is created the user can start the tasks. Based on the completion of tasks, the users are provided with points. The point system entails earning points for completing pomodoros and losing points for failing to complete pomodoros (TABLE II). These points are added together to build a leaderboard (Fig.2). The leaderboard displays rankings based on the number of points earned by users. The leaderboard has different view categories (i.e.) daily, weekly, monthly which motivates the user to top the table every day, week and month. The points system for pomodoro is given in the Table II

TABLE II. POINT SYSTEM IN PROSCORE

Task	Points
SUCCESSFUL	+10
FAILURE	-5

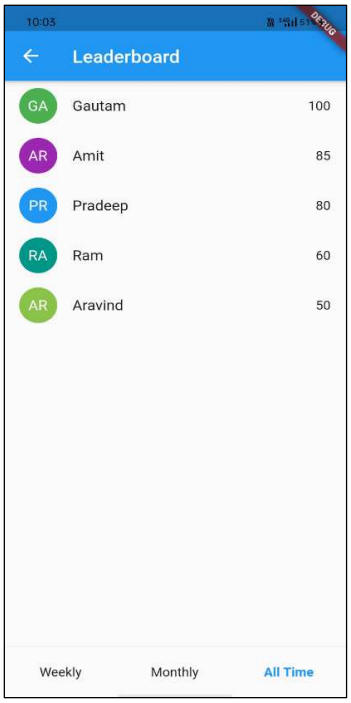

Fig. 2. Leaderboard in ProScore

C. Peer Influence

Peer pressure arises when a person is encouraged to emulate their peers by modifying their attitudes, beliefs, or behaviors to match those of the influencing group or individual [21]. This can affect the individual in either a positive or negative way, or both. Researchers have studied the impact of peer pressure on children and teenagers, and the word "peer pressure" is often used in common discourse to refer to such age groups. The ability of children to make independent decisions is a popular topic for research; peer pressure's association with sexual intercourse and drug misuse has been extensively studied in teenagers. Peer pressure, on the other hand, will influence people of all ethnicities, races, and ages. Peer pressure has moved beyond face-to-face interactions to include remote interactions. Adolescents and adults alike will use social media to instil and/or feel pressure on a daily basis [10]. Peer influences, such as pressures from other companies in their sector or from headquarters, seem to affect not just entities but also organizations, such as multinational businesses, according to research [11].

Application of Peer Influence in ProScore

In a ProScore application, when the user starts a pomodoro it is displayed as a feed to other users (Fig. 3). This in turn invokes the other users to a minimal extent of 70

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percent users to think about their tasks which are not completed because of procrastination. This pushes the users to start a pomodoro for their tasks. Some people are also obsessed in reaching the top position. So it is believed that gamification also plays a major role in the peer influence over a user. In this application as we display the user points in the leaderboard, 90 percent of the peers are intended to push themselves to improve their points in the leaderboard to obtain good rankings. Thus peer influence plays a vital part in improving the productivity of a user.

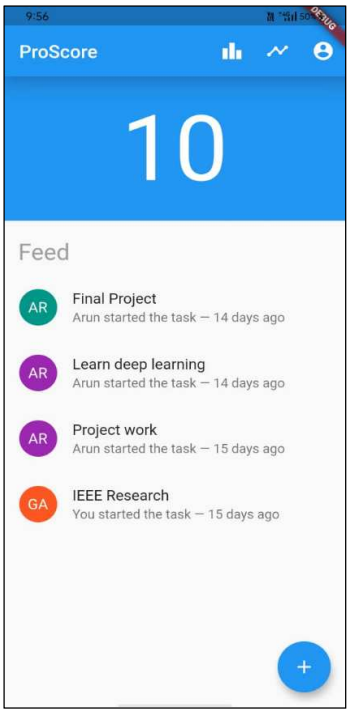

Fig. 3. Activity feed in ProScore

D. *Task Duration Estimation*

Determining how much time to allocate for tasks is an important aspect of effective time management that is often performed manually. Time estimates impact how much time people set aside for tasks during planning and when they perform tasks based on estimates of how long they need. The activity of time estimation can be challenging for users, especially for new tasks, when people may lack the experience or expertise to make accurate time estimates [12, 13]. Time estimates can also be affected by known biases, such as optimism and overconfidence [14].

Procedure for task estimation

To estimate time for any task historical information plays a major role. In our case since historical data isn't available which in turn provides a cold start problem. Cold start problems are nothing but the estimate cannot be derived for a completely new user. To overcome this problem, a new user of a specific field needs to provide explicit timing for their task as mentioned earlier. These timings are stored by the application (Fig. 5) and when the successive users of the same field use the application the time duration is estimated using the previous data. For the successive users the time is estimated by using the arithmetic mean. The application sums up the time for each user of their respective field and divides it by total available tasks. The resultant is rounded off to provide an estimated time to the user.

If any data set consisting of the values b1, b2, b3, …, bn then the arithmetic mean B is defined as, B = (Sum of all observations) / (Total number of observations)

In our case, the arithmetic mean B is the mean value of all the tasks having the same title or same category and n is the total number of tasks taken into consideration.

$$B = (\sum \text{minutesPerSession}[i]) / n \quad (3)$$

For example, assume manual milk packaging of 100 liters as the task. So one can continually work for the first 25 minutes and take rest for the next 5 minutes and then continue this cycle until the process completion as per the traditional Pomodoro technique [5]. This kind of task will work fine with the default pomodoro value. But consider the case of exercises such as bench-press or bicep curl. Here one cannot do such workouts in a stretch of 25 minutes. Also, we cannot specify the task duration since it differs for person to person and also it has numerous parameters (weight of the dumbbell, age of the person, energy level of the person, whether he is a beginner or an expert, etc.) to consider and it is such a huge area to cover. So, to not to complicate we let the task duration field to be editable and it shall be set according to the users' wish. And on every successful completion of a user defined duration, the data will be captured and the average duration is calculated and mapped to each such task. So next time when the same or another user chooses to do this task, the duration or time-estimation of the task will be set as per our record and of course the field will be still editable.

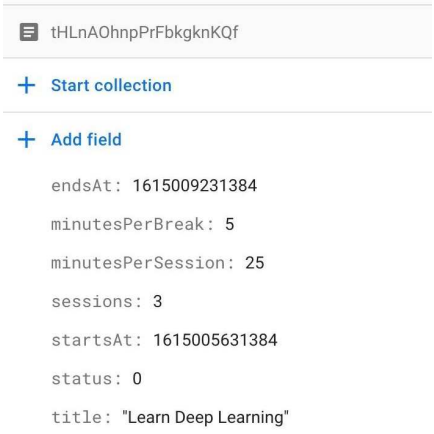

Fig. 4. Sample task stored in Firebase Cloud Firestore

The Fig. 4 shows the sample data that is stored for the pomodoro task titled "Deep Learning". The keys 'startsAt' and 'endsAt' hold the value of the task's initial time and termination time respectively. The time values are in the "Milliseconds since epoch" format which in turn is used to calculate the task duration from its start till its completion by finding the difference between the start time and the end time. The 'status' is to represent the successful completion of the

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task. The default value is set to 0 which represents an incomplete task and upon successful completion, the value will be changed to 1. The time estimation calculation, as expressed earlier, will be carried out only with those tasks whose status is set to 1. The motive behind it is to avoid unrelated time duration which are practically inappropriate. The other keys such as 'sessions', 'minutesPerSession', 'minutesPerBreak' have their values computed based on the user input and the Pomodoro session calculation as mentioned earlier.

IV. FUTURE RESEARCH

Upon continuing in this manner, this solution shall be extended with Reinforcement Learning. Arithmetic mean calculation will give a start to our model but when scaled-up, time estimation based on average value will be inefficient. According to [19], "RL does not require prior knowledge; it can create optional policies on its own, based on trial-and-error learning and constant interaction with a dynamic environment." Our framework satisfies this statement and for further research, the collected data shall be analyzed with respect to its attributes and the relationship between the tasks shall be analyzed using Pearson Correlation [17]. With the available dataset, it is then possible to estimate the task duration, which is a proven model [17] and would also result in a scalable solution.

V. CONCLUSION

To avoid procrastination and to maximize productivity, the Pomodoro Technique, Peer-influence, gamification and incentivization are customized and integrated into a single framework and a mobile application has been developed using Flutter UI and Firebase which is named 'ProScore'. During implementation, the traditional Pomodoro timer is customized to variable time inputs and we discussed the time estimation. The live activity feed and the leaderboard are the components of gamification which puts a positive pressure on individuals due to their peers which motivates them to be productive and the point system is to incentivize the users by rewarding points on each successful completion of a pomodoro task. The role of peer-influence, gamification and incentivization are discussed and ultimately derived at a successful solution on implementation. Being simple and an open source application, we believe ProScore serves the general public people in reducing their procrastination and motivates them to be productive in almost every task.

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