

A FINITE STATE MODEL FOR A SYSTEM BASED ON
THE SEVEN MAQAMS OF MINHAI AL 'ABIDIN

BY

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ABSTRACT

The concept of improving oneself by gaining knowledge and insight regarding tasawwuf is gaining popularity nowadays. Even though various materials and books are available but only for reading, it is up to the user to decipher what necessary actions and knowledge is required to enhance oneself in the spiritual realm. However, a system offering the assessment of a person's current state with the opportunity to learn the ways of spiritual enhancement in religious context is not there. For any kind of improvement to be beneficiary and stable, they need to transpire in incremental stages. The system will have a familiarity with states and transitions, which is the essence of finite state models. Finite state models are very versatile, applicable to the analysis and design of both abstract and physical systems. So, there is a need for a finite state model that will provide relevant search criteria for the user to not only assess his or her current state but also to provide access to resources and information that will help the user to journey through the states accordingly for self-improvement. First an extraction framework has been developed to manually extract and assess the relevancy of texts from the book Minhaj al 'Abidin authored by Imam Ghazali (r.a) to identify the states and based on the physical and psychological constructs the triggers and that activates the transitions from one state to the other. Then a finite state model has been developed based on the relevant texts as states and triggers, along with the concept of attributes has been introduced as a tool to provide feedback to the users to improve. Design based research methodology was used for iterative analysis, design, development, and implementation of the finite state model and text extraction model.

A prototype system entitled Self-Help Maqam-Based Search system based on the finite state model designed, was built, this allowed the experimental validation of the finite state model and text extraction framework. Results from performance testing using open-source tools and user feedback proved the efficacy of using finite state modelling in the system. And quantitative data collected from the system and after being statistically analyzed showed a positive correlation between hours spent, age group and attainment of higher maqam levels. This validates that self-help interventions using religion as content do help in the process of spiritual enhancement.

الملخص

في هذه الأيام، أصبح مفهوم تحسين الذات من خلال اكتساب المعرفة والبصيرة بشأن التصوف يكتسب شعبيةً أكثر، فعلى الرغم من توفر العديد من المصادر والكتب المتاحة للقراءة فقط، فإن الأمر متروك للقارئ ليقوم بتحليل وفهم الإجراءات والمعرفة اللازمة والمطلوبة التي من شأنها تعزيز الذات في العالم الروحي. ومع ذلك، لا يوجد هناك نظام يجمع بين تقييم للحالة الحالية للشخص مع توفير فرصة لتعلم طرق التعزيز الروحي في السياق الديني. ومن أجل أن تكون أي طريقة من طرق التطوير نافعة ومستقرة، فيجب أن يتم إتباعها عبر مراحل تدريجية. سيكون هذا النظام نظاماً قائماً على الإمام بالحالات والمراحل الإنتقالية؛ الأمر الذي يعد جوهر نماذج تحديد الحالة، ولذلك، فإن هناك حاجة إلى نموذج تحديد الحالة ليقوم بتزويد المستخدم بمعايير بحث ذات صلة به، وذلك ليس من أجل تقييم حالته الحالية فقط، ولكن أيضاً من أجل توفير الوصول إلى الموارد والمعلومات التي ستساعده على الانتقال من حالة لأخرى وبالتالي تطوير الذات. أولاً، لقد تم تطوير إطار عمل لاستخراج وتقييم مدى ملاءمة النصوص من كتاب منهاج العابدين الذي ألفه الإمام الغزالي (رضي الله عنه)، وذلك لتحديد الحالات، ومستنداً إلى التركيبات الجسدية والنفسية التي بدورها ستشير وستؤدي إلى تنشيط الانتقال من حالة إلى أخرى، ثم تم تطوير نموذج تحديد الحالة بناءً على النصوص ذات الصلة لاستخدامها كحالات ومحفزات، جنباً إلى جنب مع مفهوم السمات الذي تم تقديمه كأداة لتوفير التغذية الراجعة للمستخدمين وذلك بهدف التطوير، حيث أنه تم استخدام منهجية البحث القائمة على التصميم وذلك للتحليل والتصميم والتطوير والتنفيذ التبعي لكل من نموذج تحديد الحالة ونموذج استخراج النص.

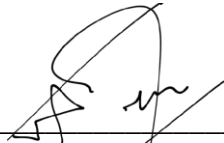
لقد تم بناء نظام نموذجي بعنوان "نظام البحث القائم على مقام المساعدة الذاتية" والقائم على أساس نموذج تحديد الحالة المصمم؛ الأمر الذي سمح بالتحقق التجريبي من نطاق عمل نموذج تحديد الحالة

واستخراج النص. وقد أثبتت النتائج من اختبار الأداء المستخلصة باستخدام أدوات مفتوحة المصدر وتعليقات المستخدمين فعالية استخدام نموذج تحديد الحالة في النظام، وقد أظهرت البيانات الكمية التي تم جمعها من النظام بعد تحليلها إحصائياً وجود علاقة ارتباط موجبة بين الساعات التي تم قضاءها والفئة العمرية وبين تحقيق مستويات أعلى للمقام، وهذا بدوره يؤكد على أن إدخال وسيلة المساعدة الذاتية عبر استخدام الدين كمحتوى أمر من شأنه أن يساعد في عملية التعزيز الروحي.



APPROVAL PAGE

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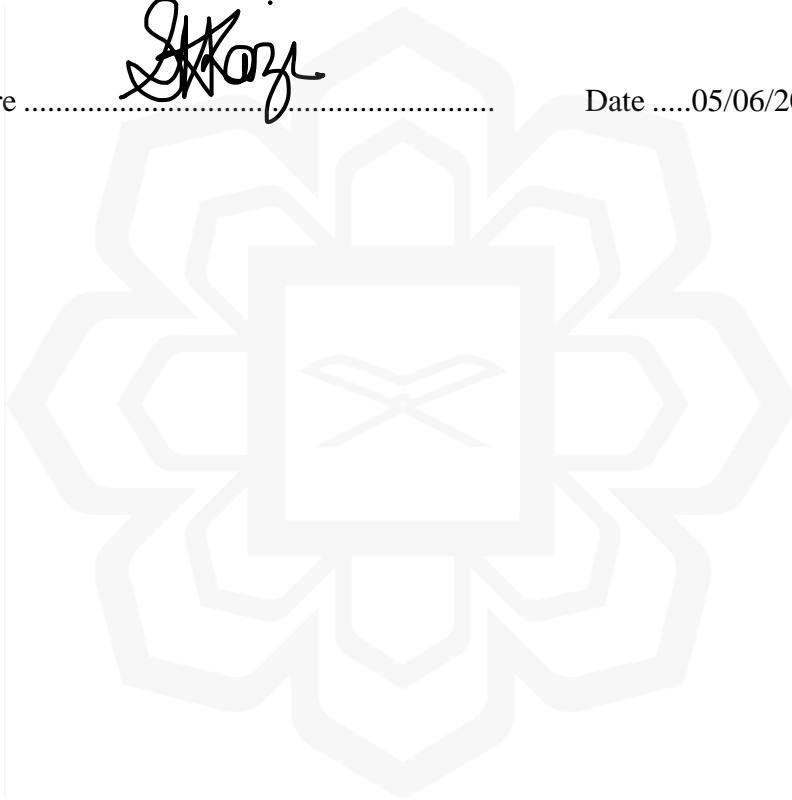
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DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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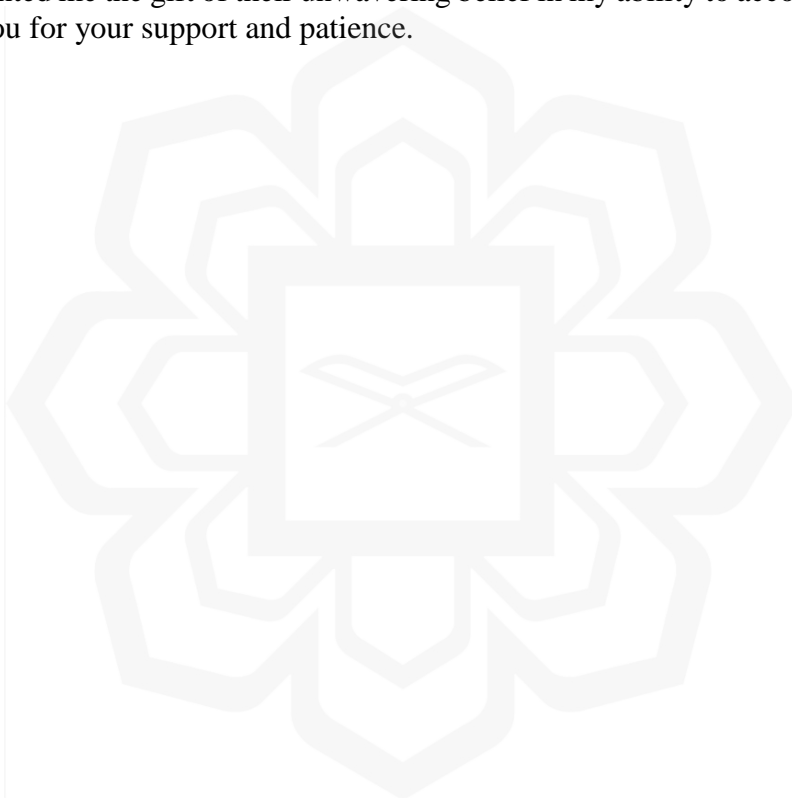


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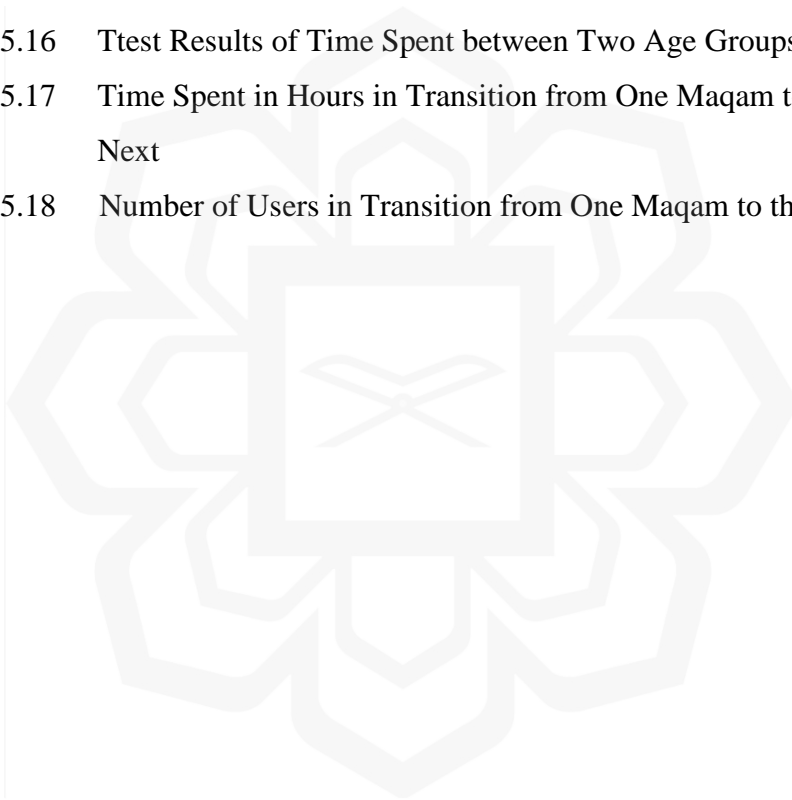


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LIST OF ABBREVIATIONS

ALI	Algorithmic Lateral Inhibition
AMD	Advanced Micro Devices
BSFM	Bayesian Finite State Model
CD-ROM	Compact Disk – Read Only Memory
CLBP	Chronic Low Back Pain
DVD	Digital Video Disk
FPGA	Field Programmable Gate Array
FSM	Finite State Machine/Model
GB	Gigabytes
GIFT	Gamete Intra Fallopian Tube Transfer
IE	Information Extraction
MES	Morpholino Ethanesulfonic Acid
PPG	Photoplethysmogram
RAM	Random Access Memory
SRL	Self Regulatory Learning
SS	Surgical System
VRML	Virtual Reality Modeling Language
X3D	Extensible 3D Graphics

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

The concept of self-help intervention is gaining headway in current times. It is reaching the acceptance of researchers and users alike as being a useful tool for individuals to solve their problems and achieve their goals. Self-help is more of a systematic process where the user utilizes the self-help material provided to conquer their difficulties and accomplish their pursued objectives (Seekles et al., 2011). Nowadays, cognitive, behavioural, or problem-solving treatment, interpersonal therapy approaches are being applied in these self-help interventions (Cuijpers and Schuurmans, 2007). Classic examples of self-help interventions are bibliotherapy (through using books) or through computer-based programs (being web-based, CD-ROM, or DVD based) (Seekles et al., 2011). Recent studies of effectiveness of self-help interventions have been seen to be contained mostly in the area of depression and anxiety disorders (Griffiths et al., 2010; Berger et al., 2011; Richardson et al., 2010); smoking and substance abuse (Blankers and Schippers, 2011); eating disorders (Wilson and Zandberg, 2012; Striegel et al., 2010). All these studies do portray the positive effectiveness of self-help interventions, as they encourage the user to evaluate the user's problem at his or her own pace and privacy. And, to find the solution by using resources provided by the self-help intervention systems. Access to information and resources are always available and are cost-effective, acting as a constant support system.

Else ways it is also regarded that religion; not only plays a significant role in improving self-control, self-monitoring, and self-regulation but also impacts what goals to choose, how to pursue them and how to manage them (McCullough and Willoughby, 2009; Rounding et al., 2012; Watterson and Giesler, 2012). Life nowadays is full of hindrances and obstacles, which one tries to conquer in different ways. Some do it by relying on families and friends, some by consulting professional help and some resolve them through their reliance on God. Muslims have always used reliance on Allah (SWT) as a coping strategy to deal with the negative influences of life from centuries ago (Ghazzali, 2001). Reliance on Allah (SWT) has been considered an essential phase of

spiritual progression in Islamic tradition (Khurasani, 2008). It is a common norm to revert to prayers and the Holy Qur'an to gain proximity to Allah (SWT) for Muslims during distress. Research have depicted that there is a positive interconnection between reliance on Allah (SWT); psychological wellbeing and self-esteem (Bonab et al. 2011).

So, it can be perceived that self-help interventions and religion implemented together; can act as an effective measure not only to be used in improving one's mental and physical health but also spiritual. Now a system offering a self-help assessment of a person's current state with the opportunity to learn the ways of improvement has not been developed yet in the concept of spiritual enhancement. There is a tremendous need for a system that will contribute resources and appropriate guidance to enhance one's spiritual state.

The system mentioned above has a familiarity with states and transitions. Thus, to ensure a more efficient and beneficial system, finite state modeling can be used to develop the general framework for the system as a whole. Finite-state machines are perfect for simple computational models that can have a finite number of states and transitions between these states (Brownie, nd).

There are several reasons why finite state model is popular for modeling. The first reason being is that it is very practical. Most practical applications are best modeled as a finite state machine. A compiler can be even written or obtained that will take a finite state machine's specification and produce code that behaves correctly. Secondly, finite state machines are important because they allow us to explore the theory of computation, which help to discover what resources are needed to compute different types of problem. (James, 2014)

Applicability of finite state machine is diverse. Finite state machines permit through iteration the improvement of the system. It also contributes to the arrangement of the logic of the systems, so that it can also be implemented to the analysis and design of abstract and physical systems. This makes it universal that is it can be applied to model various types of system.

A general finite state model has been developed that will help a system to assess the state in which the user is in and the ways that the user can transit from that state to the higher states and ultimately reach a certain goal. The general model has also been diversified to show how it can be used to add different features to the system.

For Muslims, the book by Imam Al Ghazali (r.a) on Sufism "Minhaj al 'Abidin ila Jannati Rabbi' l-amin" (The Path of the Worshipful Servants to the Garden of the

Lord of All the Worlds) acts as a guide to receive bounties from Allah (SWT). This excellent book outlines a journey that a Muslim must undertake through 7 maqams or hurdles, intending to achieve ultimate propinquity to Allah (SWT). To climb each maqam or hurdle, one needs to and acquire certain knowledge and accomplish specific tasks and duties with sincerity.

A self-help maqam-based system has been created based on the developed finite state model to test the efficacy. As for the content for the system, the book Minhaj' al 'Abidin has been used. Thus, the system will guide an individual through the seven hurdles or maqams mentioned in "Minhaj al 'Abidin." This prototype system, entitled Self-help Maqam based Search System, has been used as a use case for the finite state framework developed.

1.2 RESEARCH BACKGROUND

1.2.1 SELF-HELP INTERVENTION SYSTEMS

A self-help intervention can be explained as a psychological treatment containing a standardized psychological treatment protocol that the patient can take home and can work through it asynchronously. This convention comprises of a rule that depicts the steps that the user can take in for the most part arrange an acknowledged mental treatment for him or her. The standardized mental treatment convention can be composed down in the shape of books, but it moreover can be accessible through other media, such as an individual computer, CD-ROM, TV, video, or the Web. Contacts with specialists are not vital for the understanding of the total treatment. Self-help mediations are accessible through books (bibliotherapy) and through the computer (web-based, CD-ROM, DVD) and they can be as an immaculate self-help or a guided self-help. For the guided self-help, even though it consists of the intervention of a therapist, but these therapists only act as a facilitator or a general supporter. They do not create a classical association with each other. Their role is to only give support in terms of how to work through the standardized psychological treatment system. To keep in touch with the therapists, users or patients do it through personal contact, by telephone, by e-mail, or by any other applicable means of communication. (Cuijpers et. al, 2007)

Cognitive-behavioral techniques are the basis for most self-help interventions for anxiety disorders. There are exposure, cognitive restructuring, and applied relaxation. As shown in variety of well-defined research and studies it has been proven that cognitive-behavioral interventions are considered to be the current state-of-the-art

treatment for anxiety disorders. This is because they prove to be effective and often more premium when compared to other methods of treatment for anxiety disorders. Also, these techniques are very straightforward and can be easily broken down into smaller steps as compared to other common psychological treatments, such as psychodynamic or interpersonal therapies (Cuijpers et. al, 2007).

Self-help interventions can be displayed and implemented in various formats and settings. The following major types of self-help has been established ("Benefits of Self-help", 2016):

1) *Unguided self-help*

To begin with, numerous self-help books can be bought in a bookstore by anybody who considers they may be of advantage. There's no proficient or paraprofessional backup, and the "patient" can suspend "treatment" anytime he or she chooses. It too is conceivable to convey unguided self-help through the Web or through stand-alone individual computer programs.

2) *Self-help as partial replacement of face-to-face therapy*

Self-help mediations moreover can be utilized as portion of a standard treatment. For illustration, a specialist giving face-to-face treatment can provide a quiet a self-help book in arrange to speed up the treatment handle or to grant the quiet the opportunity to memorize the standards of the treatment exterior treatment. The patient moreover might get a palmtop computer as portion of a customary treatment, in which the palmtop is utilized to incite the quiet to hone one of the treatment components. It too regularly happens that a advisor exhorts the understanding to purchase a self-help book on a related issue, such as a rest issue or a mild liquor issue that's not the center of the treatment but does meddled with the patient's working.

3) *Self-help as an independent intervention*

Self-help can be conveyed as an independent intervention. Ordinarily, there is some form of support from a proficient or paraprofessional in this sort of intercessions. Research have mostly centered on the adequacy of this type of self-help interventions. In these studies, the patient gets a self-help book and works through it freely whereas a proficient or paraprofessional has contact with the understanding of the patient by phone at standard times. These contacts are brief and are not pointed at creating a conventional relationship between patient and advisor.

Moreover, contacts are kept essentially at giving clarification and explanation of using the system and trying to encourage and motivate the patient in continuing the use of the system. Nowadays, the Internet has grown increasingly vital as a medium for conveying guided and independent self-help treatments. Most research has emphasized on this type of self-help, as it contains an independent less contact intervention. This can be used as a surrogate to psychotherapy or medication.

Self-help systems have been proven to show the benefits of being

1) Empowering

Developing a self-help plan keeps one in control of one's destiny. The skills and methods learnt while engaging in the self-help process are likely to be generally helpful to across many different aspects of one's life. It is also emotionally rewarding to be able address concerns on his or her own, which makes the person feel responsible to improve on those issues.

2) Delivers a customized plan

Designing own self-help plan means that one can customize the efforts so that they fit their own strengths and weaknesses and reflect their personal choices about how to best address the specific issues.

3) Enables to develop a better, wiser person.

By increasing one's self-awareness capabilities, self-help efforts can help to learn to pinpoint possible problems before they can happen (early on in their advancement). So that he or she can solve and deal with them before they become more problematic. As the objectivity (the ability to see things as they are, rather than how one would like them to be) increases, thus finding oneself increasingly able to be the user's own best adviser, steering oneself away from bad decisions and towards good ones with a minimum of fuss.

4) Time saver

Pursuing self-help efforts saves the time otherwise needed to spend with a therapist or counsellor who could help with problems.

5) Private.

Sometimes people are not comfortable with sharing private secrets and thoughts with others. Then the user can benefit from using a self-help system, where he is not required to share anything private with others, which might cause him embarrassment.

6) *Available and inexpensive*

Self-help is usually inexpensive and does not cost a lot of money to use and learn about. If users live in remote areas, then self-help will be the only option for him to avail.

Recent studies of effectiveness of self-help interventions have been seen to be contained mostly in the area of depression and anxiety disorders (Griffiths et al, 2010; Berger et al., 2011; Richardson et al., 2010); smoking and substance abuse (Newman et al., 2011; Blankers and Schippers, 2011); eating disorders (Wilson and Zandberg, 2012; Striegel et al., 2010). All these studies do portray a positive effectiveness of self-help interventions, as they encourage the user to evaluate user's problem at his or her own pace and privacy. And, to find the solution by using resources provided by the self-help intervention systems. Access to information and resources are always available and is cost effective, acting as a constant support system.

1.2.2 FINITE STATE MODELS

Finite State Machines are abstract machines. They contain of a set of states, set of input events, a set of output events and a state transition condition. The state transition condition allows by the combination of the current state and an input event to return a new set of output events and the next state. Thus, it can be observed as a function, which maps an ordered sequence of input events into a corresponding function to a set of output events. (Aziz et al., n.d)

The state that the machine belongs to at a current time is called the current state, and the machine can be in a single state at a time. Transition is the change from one state to another when initiated by a triggering event or condition. A particular finite state machine can be explained by a list of its states, and the triggering condition or function for each transition.

A state machine is the logical part of any system responsible for the system behavior. Sometimes combinational systems are treated separately, and sometimes they are considered a kind of degenerated state machine, with only one possible state. (Wagner et al. 2006)

For simple computational model's perspective finite-state machines are ideal to be used for designing and development purpose, specifically for those that contain finite number of states and transitions between these states (Brownlee, n.d).

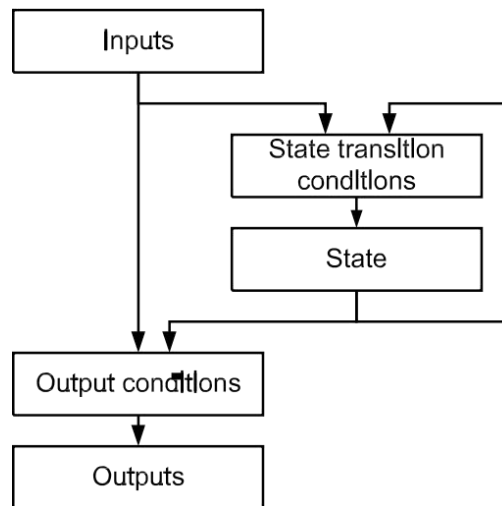


Figure 1.1: The State Machine Definition, From *Finite State Modeling Approach- A practical Approach* by F. Wagner et al, 2006, New York, NY; Auerbach Publications.

Referring to figure 1.1, a finite state machine consists of 4 main elements which are:

1. States which represent behavior and may derive actions
2. State transitions which are the progression from one state to another
3. Rules or conditions which must be matched to permit a state transition
4. Input events which are either externally or internally provoked, cause to trigger the conditions which ultimately prompt state transitions

A finite state machine must have an initial state, which provides a starting point, and a current state, which remembers the product of the last state transition. When the machine receives input events, which will act as triggers. These triggers will make the machine to evaluate the conditions that govern the transitions from the current state to other states. (Brownie, n.d.)

State transition diagrams also known, as state diagrams are the most common diagrams that are used to display as shown in figure 1.2, the state diagram is a directed graph where each vertex represents a state and each edge between the vertexes portrays a transition between two states. Usually, the state transition diagram gives an overall impression about the state machine, displaying the states and transitions quite well but the details are somewhat hidden. The actions are not represented in detail. Thus, a state transition diagram needs to be supported by state transition tables that contain the full