BAHAGIAN PENYELIDIKAN & PEMBANGUNAN
CANSELORI
UNIVERSITI SAINS MALAYSIA

Laporan Akhir Projek Penyelidikan Jangka Pendek

1) Nama Penyelidik: Prof. Madya Rabindarjeet Singh

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2) Pusat Pengajian/Pusat/Unit : Jabatan Fisiologi dan Jabatan Pembangunan, Universiti Sains Malaysia, Cawangan Kelantan

3) Tajuk Projek: Rekacipta Sistem Latihan Berkomputer Atlet untuk Rentak dan Kelajuan *(Development of a computerised athletic training system for pace and speed)*

4) (a) Penemuan Projek/Abstrak

(Perlu disediakan makluman di antara 100 - 200 perkataan di dalam Bahasa Malaysia dan Bahasa Inggeris Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Pembangunan sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti).

Abstract

The development of appropriate fitness field test is generally considered to be one of the essential tasks of sports sciences. In athletics, running on a treadmill in a laboratory will only determine the fitness level of the athlete and not train the athlete in pace and speed which is important for success and even setting of records. To our knowledge, there has been no such simulated training programme for athletes to train in pace and speed.

A computerised pace setting system for athletics with well-defined pacing levels, which is analogous to the usual form of ergometry, was developed. It has the capacity, pacing and speed required for middle and long distance pacing and running. The preliminary programme was written in the Computer Language C^{++} (Borland Int.), which allows the flexibility of changing the sequence of light flashes indicating pace (speed) of running. It is hoped that this computerised simulated athletic training system will allow reliable estimates to be made on the speed and pacing of athletes and that it may be used effectively in place of or in addition to laboratory tests.

Abstrak

Rekacipta sesuatu ujian padang untuk kecergasan yang sesuai secara amnya merupakan satu tugas/tanggungjawab yang diperlukan dalam bidang sains sukan. Dalam arena atelitik, berlarian di atas treadmil dalam makmal adalah untuk mengukur tahap kecergasan atelit, tetapi bukan untuk latihan mengawal rentak dan kelajuan larian atelit, dimana kedua-dua komponen ini adalah penting untuk mencatatkan kejayaan dan rekod. Dari pengetahuan kami sehingga kini masih tiada program simulasi latihan sebegini untuk atlit berlatih mengawal rentak larian dan memecut.

Satu sistem rentak larian berkomputer yang mempunyai tahap rentak larian tertentu yang serupa dengan bentuk ergometer telah direkacipta. Sistem ini berkeupayaan untuk mengawalatur rentak larian dan kelajuan optimum yang perlukan untuk larian jarak sederhana dan jarak jauh. Program awal sistem ini ditulis dalam bahasa komputer C^{++} (Borland Int.), di mana ia memberi kebebasan untuk mengubah turutan nyalaan lampu yang menunjukkan rentak kelajuan larian. Kami berharap sistem simulasi latihan atelitik berkomputer ini dapat mengukur kelajuan dan rentak larian atlit dengan tepat, seterunya merupakan salah satu ujian tambahan atau yang dapat mengganti ujian makmal yang efektif.

2 A

(b) Senaraikan Kata Kunci yang digunakan di dalam abstrak:

Bahasa Malaysia	Bahasa Inggeris
.....	.....
atelitik	athletic
ujian khusus sukan	sports specific testing
program simulasi	simulated programme
ergometri	ergometry
ujian kecergasan padang	fitness field test
merentak	pacing
.....	.....
.....	.....
.....	.....

5) **Output Dan Faedah Projek**

(a) Penerbitan *(termasuk laporan/kertas seminar)*
(Sila nyatakan jenis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).

Pembentangan Kertaskerja

DEVELOPMENT OF A SIMULATED ATHLETIC TRAINING SYSTEM FOR SPEED AND PACE
Rabindarjeet. Singh, N. Mahamood*, Ang Chin Han, Ang Boon Suen, and Zahari Razak*
Exercise Physiology Laboratory, Department of Physiology, School of Medical Sciences, *Department of Development, Universiti Sains Malaysia, 16150 Kelantan, Malaysia.
Di Kongres Saintifik Komanwel & Antarabangsa ke XI, Universiti Malaya, 4-8 September 1998

Pertandingan Reka Cipta Negeri Kelantan

SISTEM LATIHAN ATLIT BERKOMPUTER
Rabindarjeet. Singh, N. Mahamood*, Ang Chin Han dan Ang Boon Suen
Fitness & Performance Laboratory, School of Medical Sciences, *Department of Development, Universiti Sains Malaysia, 16150 Kelantan, Malaysia.
Semperna Minggu Penggalakan Sains dan Teknologi Peringkat Negeri Kelantan 1998, 8-10 November di Kota Bharu

(b) Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten.
(Jika ada dan jika perlu, sila gunakan kertas berasingan)

Satu sistem rentak larian berkomputer yang mempunyai tahap rentak larian tertentu yang serupa dengan bentuk ergometer telah direkacipta. Sistem ini berkeupayaan untuk mengawalatur rentak larian dan kelajuan optimum yang perlukan untuk larian jarak sederhana dan jarak jauh.
Pada pendapat kami sistem ini mempunyai prospek komersialisasi yang baik.

6. **Peralatan Yang Telah Dibeli:**

Sebuah komputer laptop
Beberapa komponen elektronik untuk mereka interface
Beberapa gulung dawai termasuk "bulb holder" dan bulbs

UNTUK KEGUNAAN JAWATANKUASA PENYELIDIKAN UNIVERSITI

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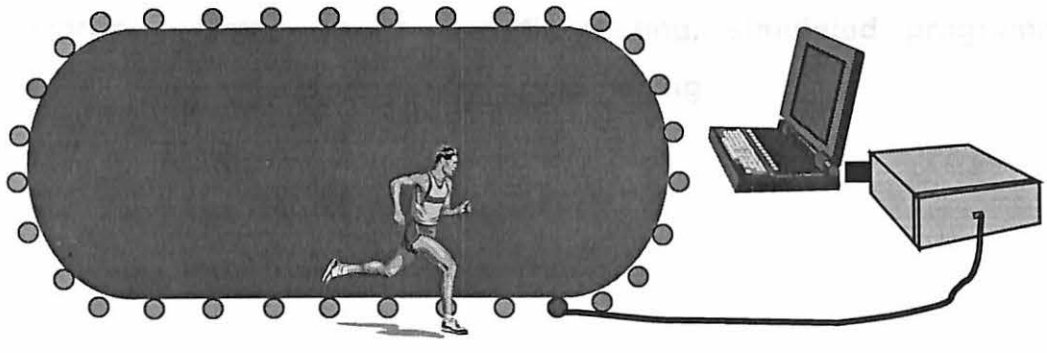
T/TANGAN PENGERUSI
J/K PENYELIDIKAN
PUSAT PENGAJIAN

PROF MADYA (DR) MAFAUZY MOHAMED
Dekan
Pusat Pengajian Sains Perubatan
Universiti Sains Malaysia
16150 Kubang Kerian
Kelantan

DEVELOPMENT OF A COMPUTERSIED ATHLETIC TRAINING SYSTEM FOR PACE AND SPEED

REKACIPTA SISTEM LATIHAN BERKOMPUTER ATLET UNTUK RENTAK DAN KELAJUAN



ASSOC. PROF. RABINDARJEET SINGH
IR. NORAZMAN MAHAMOOD*

Fitness & Performance Laboratory
*Development Deparment
Universiti Sains Malaysia
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Kelantan

Abstract

The development of appropriate fitness field test is generally considered to be one of the essential tasks of sports sciences. In athletics, running on a treadmill in a laboratory will only determine the fitness level of the athlete and not train the athlete in pace and speed which is important for success and even setting of records. To our knowledge, there has been no such simulated training programme for athletes to train in pace and speed.

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Key words: **athletic, sports specific testing, simulated programme. ergometry, fitness field test, pacing**

Abstrak

Rekacipta sesuatu ujian padang untuk kecergasan yang sesuai secara amnya merupakan satu tugas/tanggungjawab yang diperlukan dalam bidang sains sukan. Dalam arena atelitik, berlarian di atas treadmil dalam makmal adalah untuk mengukur tahap kecergasan atelit, tetapi bukan untuk latihan mengawal rentak dan kelajuan larian atelit, dimana kedua-dua komponen ini adalah penting untuk mencatatkan kejayaan dan rekod. Dari pengetahuan kami sehingga kini masih tiada program simulasi latihan sebegini untuk atlit berlatih mengawal rentak larian dan memecut.

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Kata Kunci: **atelitik, ujian khusus sukan, program simulasi, ergometri, ujian kecergasan padang, merentak**

INTRODUCTION

The development of appropriate fitness test is generally considered to be one of the essential tasks of sports sciences. Competition experience and the results of many investigations (1) have shown that customary ergometry laboratory tests (cycle–ergometry and treadmill) are not sufficient for an unequivocal prediction of success in sport or forecasting the results of competition. In part, these may be explained by the unfamiliar surroundings of the laboratory or the test. In sports, such as badminton, squash and handball which involves non-rhythmic movements and characterised by a complicated time-course of movement, sports-specific testing is either impossible or would require elaborate and expensive technical equipment. Such conclusions have prompted further reserch on possible means of obtaining valid estimations of the competition fitness of athletes in specific sports such as squash and badminton. Similarly, in athletics, running on a treadmill will only determine the fitness level of the athlete and not train the athlete in pace training.

For all reasons, recent efforts have been directed towards performing the fitness tests in the framework of so-called field tests made at the training place under-competition-stimulating or actual competition conditions. Results and experience gathered in recent developed field tests in squash and badminton (2-3) show that they have a high prognostic value.

Therefore, developing appropriate field tests which mimic actual competition conditions, develops appropriate energy systems and develops the athlete's physique is very important for court games such as badminton (3) and squash (2,4). Similarly in athletics, pace setting are important for success and even setting of records which requires good technique and adequate tactical abilities which also requires a high level of anaerobic and aerobic energy systems (5,6).

Although sport-specific fitness testing for squash and badminton are available(1,2,7) there is no system, specific for athletics which is capabale of measuring, evaluating and improving the athletes in terms of pace and speed.

OBJECTIVE

The purpose of this study is therefore was to developed a computerised pace testing system for athletics with well-defined pacing levels which are analogous to the usual form of ergometry and which will test the capacities, pacing and speed required for middle and long distance pacing and speed running.

COMPUTER PROGRAMME

The programme was written in the computer language C^{++} (object oriented) with a 80286 assembly using Borland C^{++} 2.0 (Borland Int.) and Turbo Assembler 2.0, which allows the flexibility of changing the speed of light flashes which indicate pace (speed) of running. The programme was designed to run only on 286s or better computers. It requires either a CGA, EGA, VGA or SVGA monitor. It does not run on 8086/88 or monochrome display cards. The Athletic Trainer user the BIOS to "talk" to the interface, not a direct in/out port command.

The interface has two electronic circuit boards with 8 outputs each, giving a total of 16 outputs. With these 16 outputs from the interface, 32 lamps (pair of 16 lights) are fitted to a 400 m track model or positioned on the actual 400 m track at a distance of 12.5 m (see Figure 1).

The lamps which are connected to a hard-ware system (driver, interface) is then in turn connected to a computer which has this specific athletic trainer programme (Figure 1). Timing (in seconds), length of a certain speed (in seconds) and setting for each level of speed can be input and saved. Once the progarmme is set, the athlete is then instructed to run from the starting point on the track and keep pace with light movement around the track on the 400-meter track (Figure 1). If the athlete is slow, the athlete will lag behind the lighted lamp and if the athlete is fast he/she will in front of the lighted lamp.

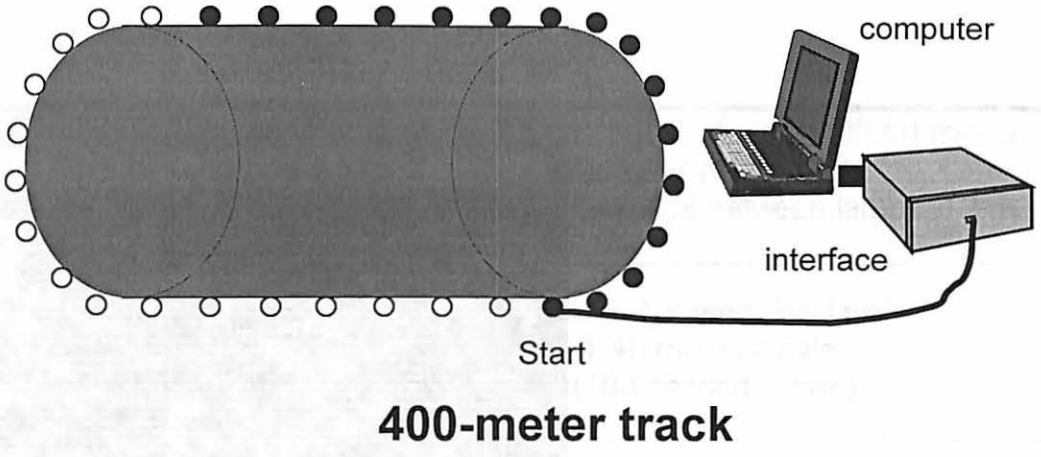


Figure. 1. A 400 m track showing the position of the 16 pairs of lamps (32 lamps in all)

Athletic Trainer is designed with ease of use in mind with minimal documentation is required since most of the commands or functions of the software are self-explanatory and presented on the screen.

THE PROGRAMMME

The screen is divided into four boxes or "window". It has the menu window, the sequence window, the status/message window and the simulated 400m track window (with lettering from 1 to 9 continued with lettering A to G in sequence) (see Figure 2)

The menu window displays choices for the user. By using the up/down arrow keys, the user can move the highlighted bar up or down. The explanation of that particular choice is displayed at the bottom of the screen (see Figure 2). Selection is made by highlighting a particular selection and pressing the ENTER Key or pressing the appropriate number key which is on the left of the choice (Figure 2).

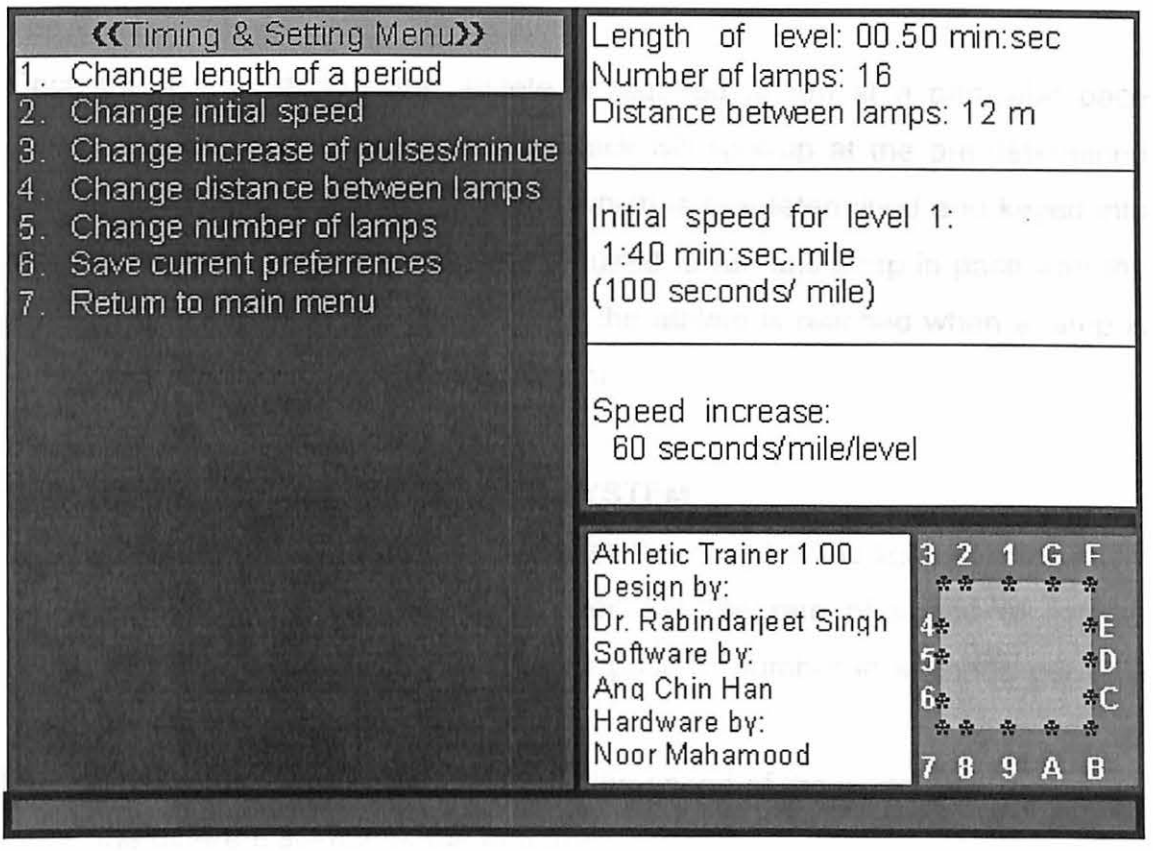


Figure 2. The screen is divided into four boxes or "windows": the menu window (on the left, the status/message window (top right), the simulated 400m track window (with numbers from 1 to 9 continued with lettering A to G in sequence) (bottom right) and the information window (bottom middle).

Selecting "**Change timings and settings**" allows one to change a number of parameters such as length of period of a particular pace, Initial speed, pulses per minute, distance between lamps and number of lamps on the model (Figure 2).

The sequence window displays the sequence of the lights on the simulated 400 m track. The simulated 400 m track represent the state of the lights in the

actual 400 m track or part of the track. The number represent the light as positioned on the actual 400 m track or model track (see Figures 2 and 3). The black star will turn to white to indicate that particular light position to be lighted up. The status/message window displays the message to the user. The message or status displayed depends on whatever the user is doing.

The Test

Once the test is started, the athlete is required to run at a particular pace around the track. The lamps on the track will light-up at the pre-determined pace/speed for a stated period of time which is pre-determined and keyed into the programme. The athlete is then required to run and keep in pace with the lighted lamps. Subjective exhaustion of the athlete is reached when a lamp is lit before the athlete reaches the lighted bulb.

LIMITATIONS OF THE DESIGN AND SYSTEM

i) The system is only able to decrease the speed of the light after the initial period of a certain speed is over, i.e. the rate of speed of lighting changes to a lower value when a positive number in seconds per mile per level is entered.

ii) The system is not able to change the speed of the lighting system within the different section of the 400 track.

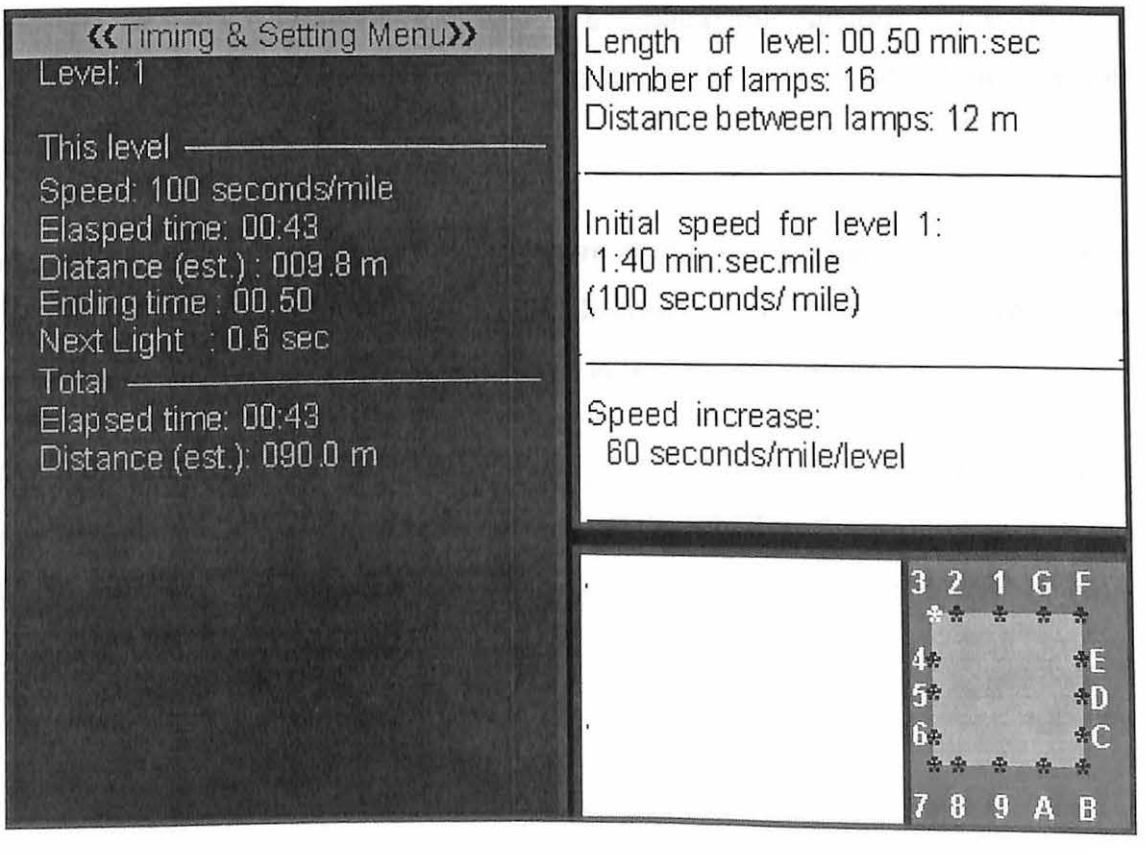


Figure 3. The simulated 400m track window (bottom right) indicating the position of the lighted lamp, which in this case is at position 3 where the black star turns to white.

CONCLUSION

In conclusion, this athletic trainer, a computerised simulated field test of pace and speed will allow a reliable estimate to be made on the fitness of the athlete. It also at the same time train the athlete to pace in middle and long distance event of any athletic meet so that pre-mature exhaustion is not reached.

This system can be used effectively in place of or in addition to the laboratory tests. This system will also allow the scientist and the coaches to actually monitor the onset of blood accumulation and the heart rate during training on the actual track. It is also possible that this system can improve the athlete's physique, fitness, speed and pace that will help select the right athlete for competition. However, this was not tested within the stipulated period of the grant as the project used the maximum period of 24 months to produce the system and the Kelantan coaches were not interested in using and testing the system. We are now in the process of exhibiting this system to the National MAAU coaches in Kuala Lumpur and to the Bukit Jalil Sports School, Kuala Lumpur.

In addition to the 400 m track, this system could also be used to train athletes for short distance events such as the 100-meter and 200-meter sprint events. Here the speed component of the athlete is tested and gauged.

With slight modification to the lighting system, this programme could also be use to train swimmers for speed and pace by placing the lighted lamps in a waterproof clear tubing which is then placed at the bottom of the pool or along

the floating lane dividers. It also envisaged this system could also be used to train the cyclist for sprint type of activity in the velodrome.

THE INTERFACE

The interface, "middleman" of the computer and the lights consists of two similar controller boards linked together by a cable. The output from the computer is linked to the interface, which is in turned linked to the lights either on the model or on the actual 400m track. The cable connecting the computer from the interface linked to a serial port, either labeled COM1: or COM2:.

The boards in the interface have several switchers, including the baud rate and board number. For ease, the baud rate on both boards has been set to 9600 the first board is labeled as board #1 and the second board as board #2.

Diagnostics and Special Menus.

To access this menu, type "ATHL". The letters cannot be seen when typed and cannot be backspaced. When a mistake is made during this process, the word must be retyped without error.

Change COM port

This allows the user to select the correct COM port to which the cable from the interface is plugged to.

Change bund rate

Type the appropriate bund rate to match the bund rate with the one selected for the boards.

Change Board Number (1 or 2)

Type 1 or 2 to match the board number printed on the boards.

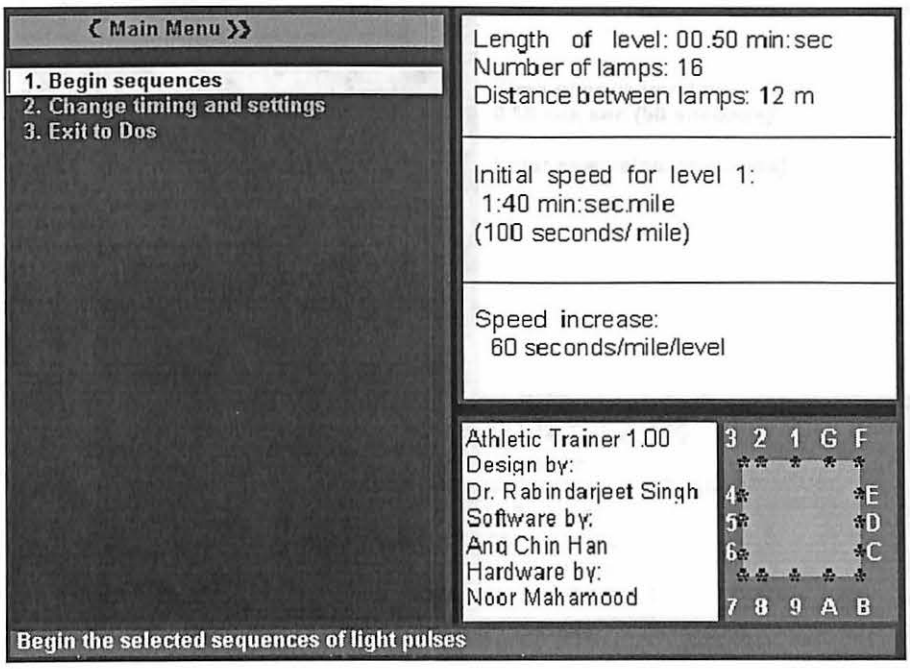
Save configuration

This saves the information of the board settings to a file so that Athletic Trainer can recall the setting hen it starts.

THE COMMANDS / FUNCTIONS OF THE SOFTWARE SYSTEM

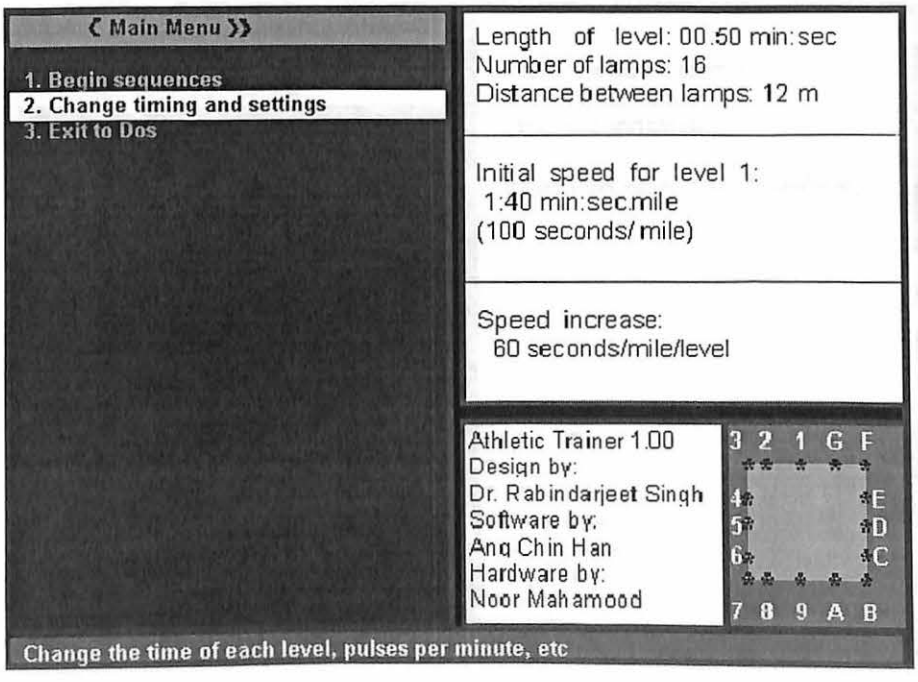
Begin Sequences

The command begins the light sequence and the athlete begins the run.



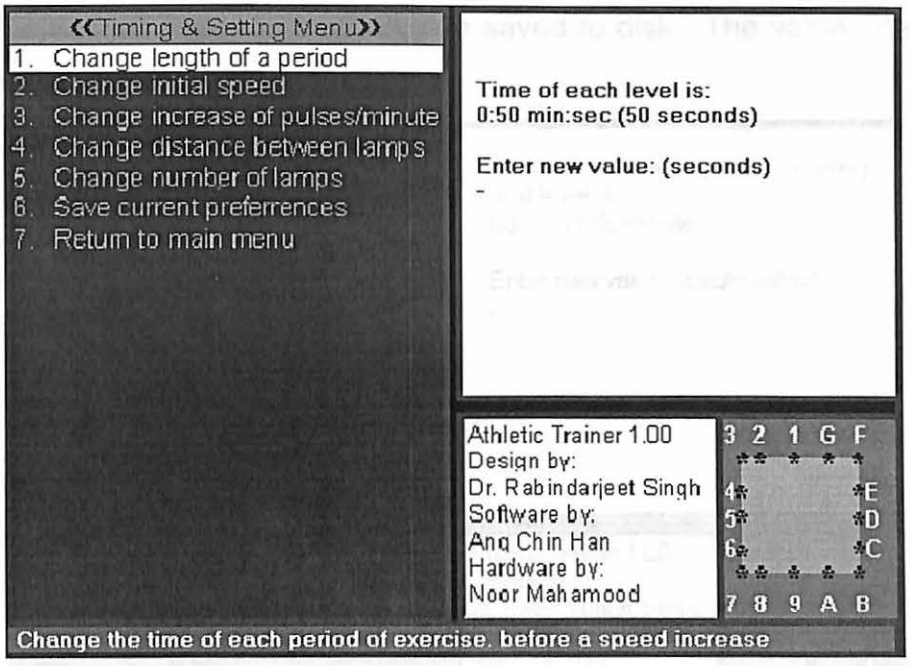
Change Timings and settings

This allows the user to individually change the sequence of light timing and setting.



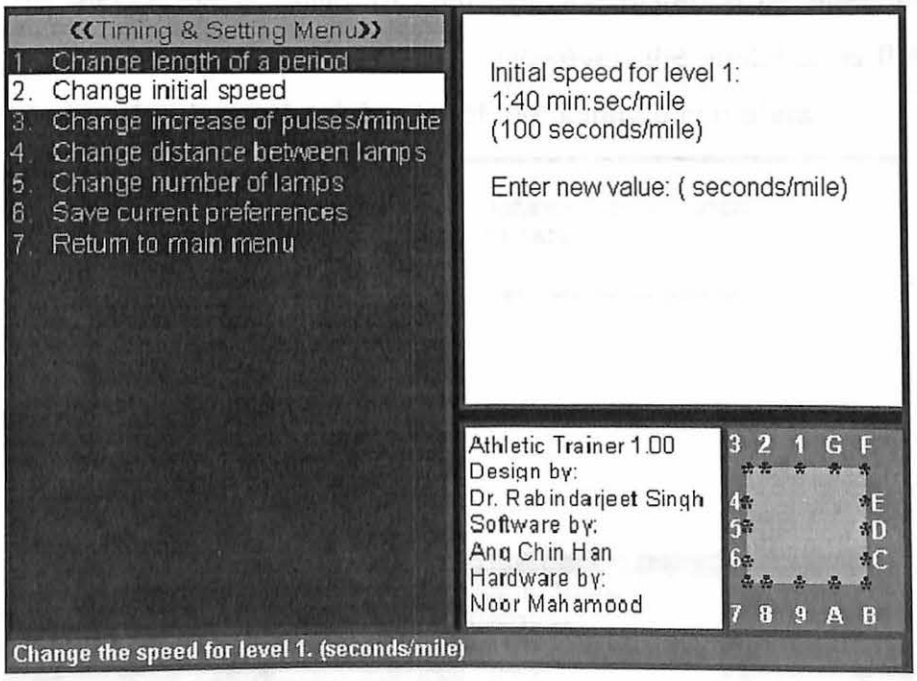
Change length of a period

This changes the time (in seconds) the athlete spends on a level before it changes to the next level or frequency of lights/min (pace)



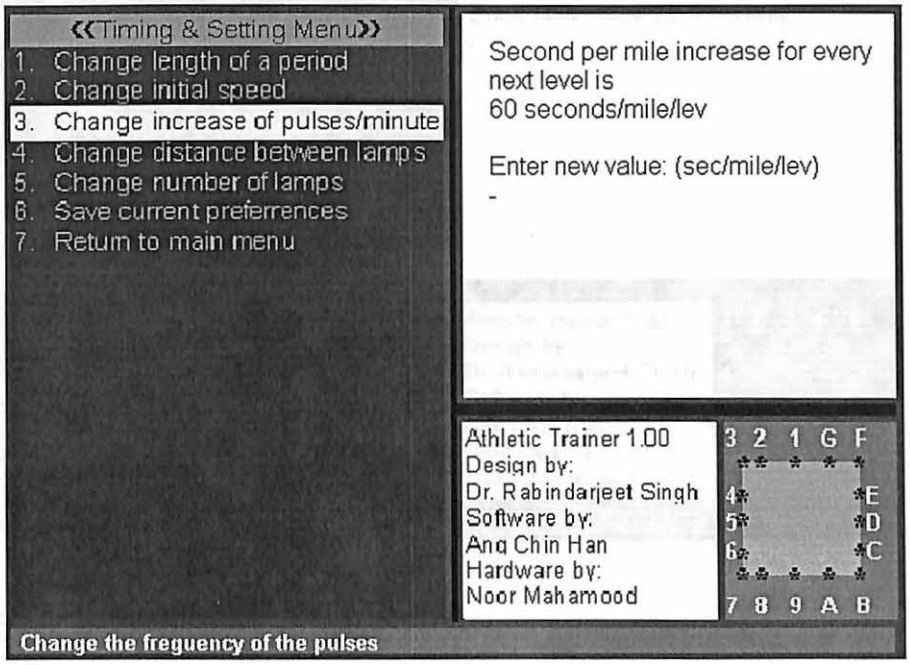
Change Initial speed

This allows the athlete to start on a particular speed, and the rate is min/sec per mile. The value entered is in seconds/mile.



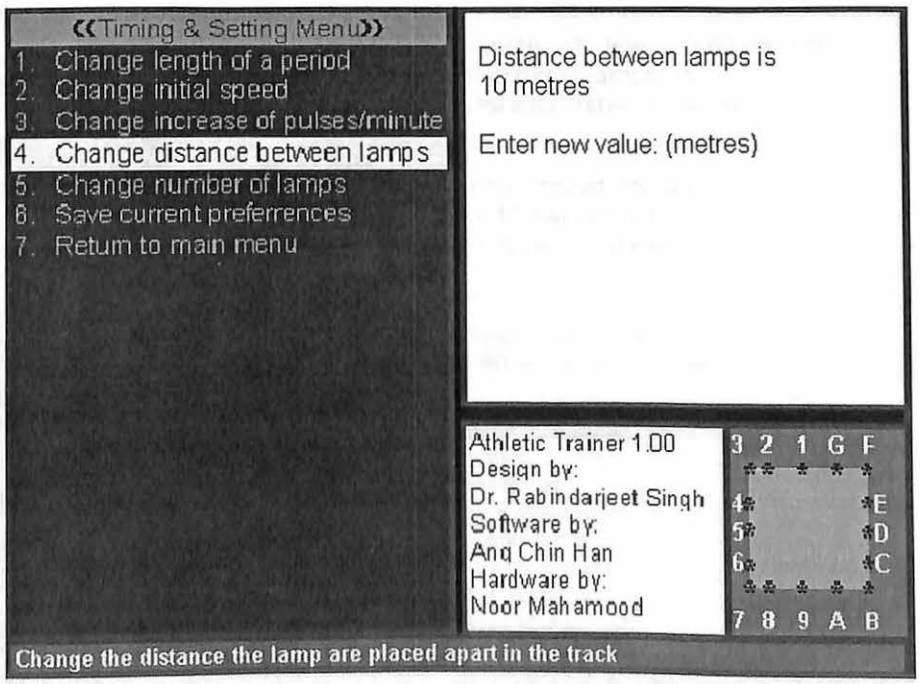
Change increase of pulse/minute/level

Changes the speed of the pulses. The speed will decrease by the value entered on every level. The minimum is 1 and the maximum is 60 while the default depends on the value saved to disk. The value entered is in seconds/mile/level.



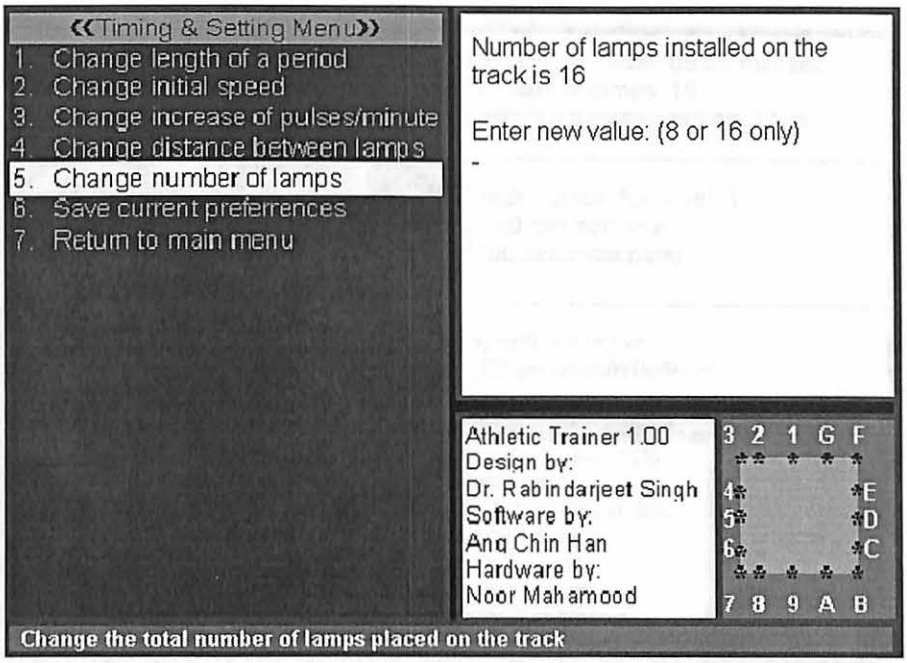
Change distance between lamps

This allows the flexibility of changing the distance between the lamps and the value entered is meters. However, the limitation is that it does not allow for decimal point entry of the distance in meters.



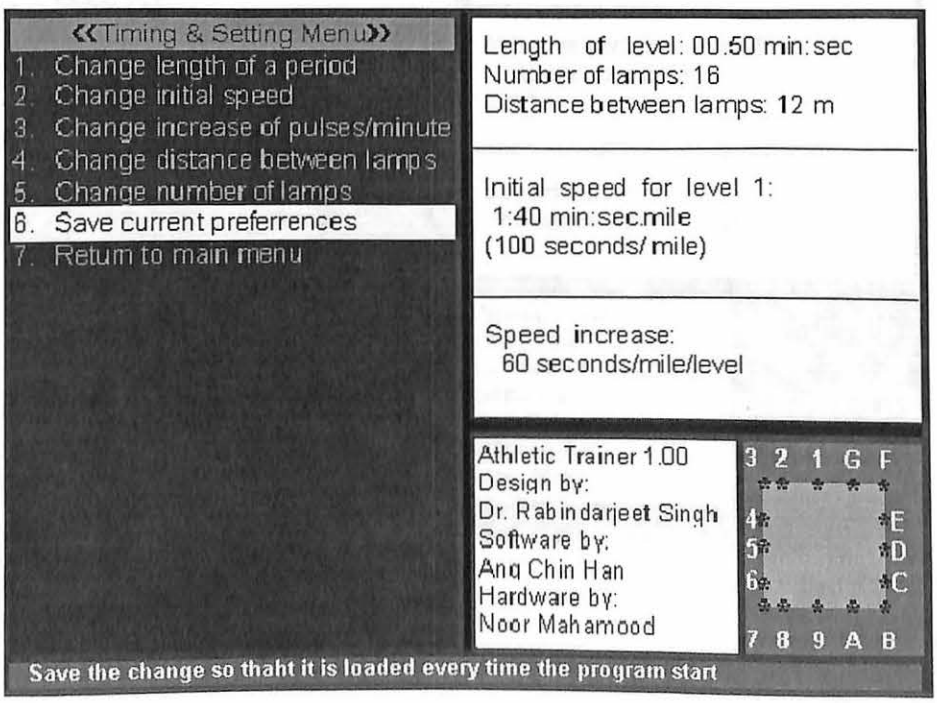
Change number of lamps

The number of lamps on the used/installed can be changed to 8 or 16 only.



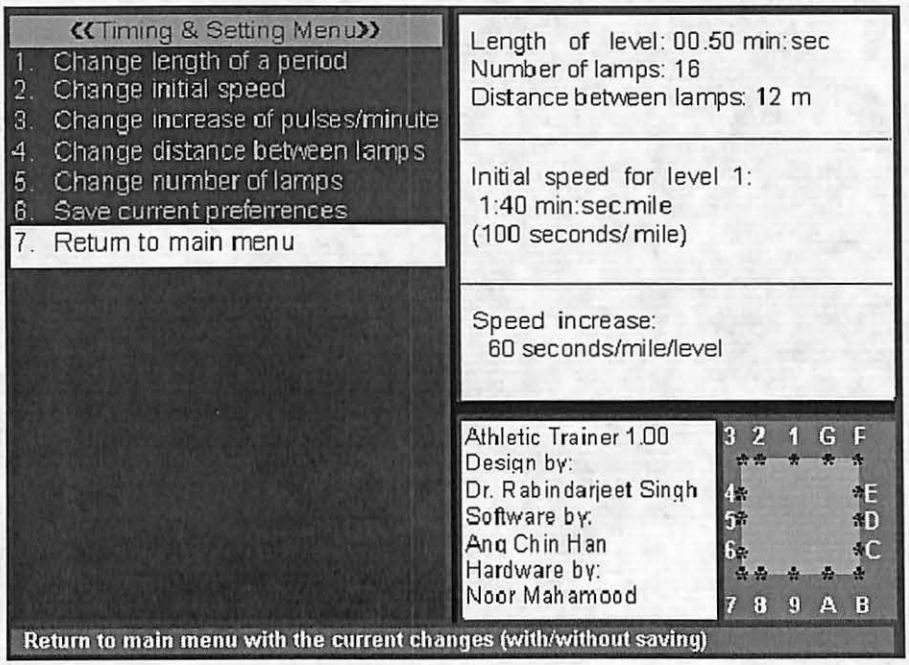
Save current preferences

This saves all the new entry/changes made to the length of period of a particular pace, the initial speed, pulses per minute, distance between lamps and number of lamps on the model. This entry saved will be loaded every time Athletic Trainer starts and will be used as default.



Return to Main Menu

This returns to the main menu with current changes either with saving of new entry data or without entry of data.



Exit to DOS

This ends the training session and exit to DOS